GREATER TORONTO AREA URBAN STRUCTURE CONCEPTS STUDY

BACKGROUND REPORT NO. 7
COMPARISON OF URBAN STRUCTURE CONCEPTS

Prepared for
The Greater Toronto Coordinating Committee

JUNE, 1990

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JUNE, 1990

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June 8, 1990

Mr. E. M. Fleming
Chairman
Greater Toronto Coordinating Committee
5 Park Home Avenue
Suite 210
North York, Ontario
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Dear Mr. Fleming:

Background Paper No. 7: Comparison of Urban Structure Concepts

This is the seventh in a series of background reports for the Greater Toronto Area Urban Structure Concepts Study. The background reports in the series are as follows:

1. Description of Urban Structure Concepts;
2. Minimal Growth Option;
3. Transportation Systems;
4. Water, Sewers and Solid Waste;
5. Greening/Environment;
6. Human Services;
7. Comparison of Urban Structure Concepts;
8. Public Attitudes Survey (to follow in Fall, 1990).

The overall study results are presented in a separate report titled Summary Report: Greater Toronto Area Urban Structure Concepts Study.

This report presents the overall comparison of the three urban structure concepts, drawing on the descriptions and analyses presented in the other six background reports. Following a brief introductory chapter, Chapter 2 describes the comparison criteria, factors and measures. Chapter 3 presents the comparison results and Chapter 4 provides interpretative comments.

In keeping with the study terms of reference, we do not provide a "bottom line" evaluation which states that one urban structure concept is "better" than another in overall terms. Rather, the three concepts are compared in terms of each of a number of criteria,

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factors and measures, using quantitative and/or qualitative measures as appropriate. The team has attempted to present these comparisons objectively and systematically, so that the reader can draw his or her own conclusions.

The interpretative comments in Chapter 4 are provided to highlight differences among the three urban structure concepts, to discuss the infrastrcuture cost implications of providing higher or lower levels of service, and to comment on possible next steps following this strategic assessment of three generic concepts.

This study breaks new ground by drawing together demand, supply, cost and effectiveness findings for three quite different future urban forms for the entire GTA including both "hard" and "soft" infrastructure. There is, therefore, little precedent against which to assess the results, some of which are perhaps unexpected or at least thought-provoking. The results are therefore preliminary, for discussion. If, as the findings are scrutinized and the comparison ratings are discussed, a consensus emerges regarding a preferred future urban structure for the GTA and/or a process for moving purposefully in that direction, the study will have served its purpose.

The opinions offered herein are those of the consultant and reflect to the extent possible comments received from the Urban Structure Subcommittee established for this study. They do not necessarily reflect the views of the Greater Toronto Coordinating Committee or the governments represented on the Committee.

We trust that the comparison results will be useful as decisions are made regarding future steps to plan and achieve ongoing development of the GTA which maintains and, where possible, enhances the quality of this great metropolis while accommodating its continuing growth in a cost-effective manner.

Yours sincerely,

IBI GROUP

Neal A. Irwin
Managing Director

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GTA Urban Structure Concepts Study: Background Report No. 7: Comparison of Urban Structure Concepts: Executive Summary

EXECUTIVE SUMMARY

BACKGROUND

The general objective of the GTA Urban Structure Concepts study is to develop three generic urban structure concepts for the GTA and provide a broad, strategic comparison of the three concepts in terms of their infrastructure requirements, the capital costs of such facilities, and a number of other important criteria. The latter include environmental quality, energy consumption, economic impetus, and the ability to achieve sustainable development, help conserve the regional and global environment, and maintain or improve the quality of life for those living and working in the GTA and areas surrounding it.

The three urban structure concepts which have been developed for this purpose are described more fully in Background Report No. 1: Description of Urban Structure Concepts. Their main characteristics are as follows:

1. a status quo concept, representing a continuation of existing trends, characterized by substantial population growth in the suburban regions at relatively low density, with continuing concentration of office development downtown and in various subcentres in Metro and the four adjacent regions (designated as **Concept 1, Spread**);

2. a concept in which substantial additional population growth/ intensification occurs within the central, built-up parts of the GTA along with further intensification of commercial growth, such that the rate of urbanization occurring beyond the existing urban boundaries would be significantly reduced (referred to as **Concept 2, Central**); and

3. an intermediate concept in which the broad distribution of people and jobs is more similar to that of Concept 1 than of Concept 2, but in which growth occurs primarily in and around existing communities in a compact form, resulting in a reduction in the rate of consumption of undeveloped land relative to Concept 1 (designated as **Concept 3, Nodal**).

OBJECTIVES AND SCOPE OF THIS REPORT

The objective of this report is to provide a systematic comparison of the three urban structure concepts in terms of the following:

INFRASTRUCTURE REQUIREMENTS

- transportation;
- hard services (water, sewer, solid waste management);
- greening/environment;
- human services.

Infrastructure system concepts were developed, as appropriate, for each of the three urban structure concepts and capital cost estimates were prepared for each, along with quantitative or qualitative assessments of operating costs, focusing in particular on differences among the three concepts.

OTHER BASIC ISSUES

A number of important issues are also addressed in the comparison, to augment the above infrastructure/cost comparison, including the following:

- urban structure;
- economic impetus;
- environmental quality;
- energy consumption;
- external impacts;
- other quality of life factors.

The comparison was conducted at a broad, strategic level.

The comparison methodology is described in the body of the report. General conclusions based on the results are summarized in this Executive Summary and more detailed comparison results and comments are presented in the report.

CONCLUSIONS: CONCEPT COMPARISONS

Based on the foregoing, the general conclusions stemming from the concept comparisons are as follows:

- **capital costs** for all three concepts are large, about $74-$79 billion in 1990 dollars, cumulative over the 31 year period 1990-2021, involving a 7% increase over recent annual per capita investment levels, but the capital cost differences among the three concepts are insignificant relative to the uncertainty range of the estimates. All three concepts are therefore rated equally in terms of this measure;

- **operating costs** for solid waste disposal are similar across all three concepts, but there are more significant differences in

transportation operating costs, with Concept 1, Spread, having the highest annual transportation operating costs in 2021 ($12.0 billion), Concept 2, Central having the lowest ($9.9 billion) and Concept 3, Nodal having intermediate costs ($11.1 billion) under this measure. Most other operating costs were treated qualitatively owing to study scope and time limitations. Concept 2 is therefore rated highest and Concept 1 lowest under this measure;

- **urban structure**: Concept 3, Nodal, generally receives higher ratings, followed by Concept 2, Central and then by Concept 1, Spread. Concept 2 would consume significantly less rural land for urbanization but Concept 3, Nodal, is seen as superior in terms of having less growth impact on existing community character, providing a wider range of community sizes, and providing a broader range of community diversity in housing types/ownership, densities and mix of residential and job activity;

- **economic impetus**: Concept 2, Central, would have the lowest impact on agriculture, forest products and mineral resource activities in the GTA and would have the lowest cost push impact on land development costs, but could have a higher risk of a land supply/demand imbalance which could lead to price increases for land, housing and employment facilities, depending on the manner in which the required growth management is carried out if this concept were adopted;

- **transportation:** Concept 2, Central, generally receives higher ratings because of shorter trips, greater transit use and generally lower transportation effort, followed rather closely by Concept 3, Nodal in terms of similar measures. Concept 1, Spread, would be superior in terms of the road network extent and level of service in the suburbs and in terms of intercity connections and access to rural areas, but would have higher levels of transportation effort (e.g. average trip distance), operating costs, and a greater possibility of road congestion in central areas because of the practical difficulty of building the necessary roads in built-up areas;

- **hard services:** all three concepts are essentially equal in terms of trunk water and sanitary sewerage systems and solid waste management costs, reflecting the postulated distributions of people and jobs. Concept 2, Central, rates

highest in terms of its low land development/redevelopment/ local servicing costs, with Concept 1, Spread having the lowest rating (highest cost) and Concept 3, Nodal, having an intermediate rating closer to that of Concept 2 than Concept 1;

- **greening/environment**: Concept 2, Central, generally has higher ratings under the measures of this criterion, followed fairly closely by Concept 3, Nodal. An exception to this is the high rating of Concept 1, Spread, in terms of its having the lowest need (and cost) to acquire new passive open space in the urbanized area, whereas Concept 2 would have a substantially higher cost in this regard followed by a slightly lower cost for Concept 3 in order to achieve equal levels of passive open space within the urbanized area under each concept. On the other hand, all three concepts would have the same cost for passive open space if the same area (the urbanized area for Concept 1) is used for the comparison, but residents of Concept 2 and, to a lesser extent, Concept 3 would have to travel farther, on average, to experience the new open space than would residents of Concept 1, since the new space would be largely in the suburbs. Both approaches are shown for the comparison under this measure and both produce the same relative comparison ratings; however, they produce different capital cost estimates which account for the cost ranges shown for Concepts 2 and 3 in terms of passive open space and greening/environment;

- **human services**: Concept 3, Nodal, and Concept 2, Central, generally have higher ratings under this criterion, followed by Concept 2, Central under most of the five relevant measures. An exception is the cultural/recreation measure, in which Concept 1, Spread, is rated as high as Concept 3, Nodal because of its relatively low capital cost for urban parks, while Concept 2, Central, is rated lowest in this regard because of the higher requirement and cost for urban parks to serve the higher central population densities under that concept;

- **external impacts**: Concept 3, Nodal, generally receives higher ratings under this criterion since, in common with Concept 2, it is anticipated to create less pressure for GTA overspill (low density) development in the rural hinterland adjacent to the GTA and this, coupled with its higher level of transit service and use in suburban areas, is likely to

create less pressure for GTA oriented road traffic in the hinterland. There may be increasing pressure under all concepts for rural development in the adjacent hinterland for "country retreats"; this could be more pronounced in Concept 2 because of its higher density, but it is difficult to assess whether there would be a difference in this regard.

Conclusions: Quality/Cost Trade-Offs

Earlier sections have noted that the substantial capital cost investments required for all three urban structure concepts relate to the level of service (quality standards) assumed in these analyses. Generally, the analyses were based on the assumption that sufficient infrastructure should be provided to achieve a similar level of service to that experienced in 1986 in the GTA, as the "basic" level of service. In addition, in one or two instances, cost estimates were provided (and included) for infrastructure investments to **improve** the level of service provided.

There are four subcomponents of the infrastructure capital cost estimates which are significant in this regard, two of them falling under the transportation criterion and two under the greening/ environment criterion, as follows:

- **transit**: substantial investment levels are estimated for improved transit under all three concepts, particularly Concept 2, Central with an estimate of $14.4 billion. This level of investment (about $460 million per year on average) would be essential in the view of the study team in order to serve the Central Concept and provide an acceptable alternative to the automobile mode, and approximately half that level of investment (about $230 million per year) would be required for improved transit even under the Spread Concept with its emphasis on an extended and improved road network;

- **roads**: the extensive capital investments estimated for new/improved roads ($19.9 billion for Concept 1, $17.0 billion for Concept 3, and $13.2 billion for Concept 2) are based on the premise that the road network would be expanded to the extent that equal levels of service would be provided under all three concepts. The cost estimates were based on the assumption that sufficient new lane-km of roads would be provided to provide peak period travel speeds similar to those experienced in 1986 throughout the GTA. This subcomponent is the largest single contributor to the estimated capital costs, comprising about 25% of the estimated total. It is possible that such a

level of investment and the impact of such roads in the central area would be considered too high and the alternative of increased road congestion in central and/or suburban areas would be tolerated instead. If this were the case, Concept 2, Central, would experience the least negative impact from such a shortfall while Concept 1, Spread, would have the greatest negative impact and the impact on Concept 3, Nodal, would be intermediate. Alternatively, more transit investments in the central, built-up areas might be made under Concepts 1 and 3 to make up for the road shortfall, incurring similar levels of capital cost to those shown above;

- **passive open space**: the initial assumption under this measure was that sufficient passive open space would be purchased **within** the urbanized area under each concept to meet the current standard of 1.8 ha per 1,000 people. It is probable that the significant cost and physical dedication of large land areas to passive open space use in existing urbanized areas ($6.0 billion under Concept 2, $4.7 billion under Concept 3 and $1.1 billion under Concept 1) would be considered to be too high, such that lower passive open space standards would be accepted. This could be achieved, as noted earlier, by providing the necessary passive open space in **the same area** (e.g. the urbanized area of Concept 1) for all three concepts. Under this assumption all three concepts would have the same capital cost for passive open space ($1.1 billion) but residents in Concept 2 (and to a lesser extent Concept 3) would have to travel farther, on average, than would suburban residents in Concept 1, to experience the passive space located in suburban areas.

- **storm water quality**: as described more fully in Background Report No. 5, measures are currently in place to improve the quality of storm water runoff in new suburban areas through measures such as settling ponds. Partial treatment of retained storm water by water pollution treatment plants during off-peak periods is a future possibility. Polluted storm water runoff, sometimes mixed with sanitary sewage because sanitary/storm sewer separation has not been completed, still remains a major problem, however, and severely degrades the quality of GTA river valleys and lakefront amenities. The existing urbanized areas, and particularly the central areas, are increasingly the major problem in this regard. It would be

> possible to spend very large sums to address this problem but it is difficult to estimate their magnitude and, accordingly, we applied a general estimate of about $2 billion to all three concepts. Concept 2, Central, would probably provide the greatest opportunity to reduce storm water runoff pollution because retention/treatment facilities could be installed more economically as part of the extensive redevelopment which would occur in central areas under that concept. If it were decided that this level of expenditure could not be maintained to improve the quality of storm water runoff, the greatest loss of opportunity would be experienced under Concept 2, followed in turn by Concept 3 and then Concept 1, but the beaches and river valleys would experience continuing negative impacts under all three concepts.

Clearly, trade-off decisions between levels of capital investments and the resulting functional/environmental standards achieved will require broad input from elected officials, staff, interest groups and the public at large. Increasing concerns regarding environmental quality and required actions to achieve sustainable development in this context will undoubtedly play an important role in this process. The strategic estimates presented here, and the discussion of some basic trade-offs, are intended to facilitate this discussion and consequent decisions.

GTA Urban Structure Concepts Study: Background Report No. 7: Comparison of Urban Structure Concepts

1. INTRODUCTION

1.1 BACKGROUND

The general objective of the GTA Urban Structure Concepts study is to develop three generic urban structure concepts for the GTA and provide a broad, strategic comparison of the three concepts in terms of their infrastructure requirements, the capital costs of such facilities, and a number of other important criteria. The latter include environmental quality, energy consumption, economic impetus, and the ability to achieve sustainable development, help conserve the regional and global environment, and maintain or improve the quality of life for those living and working in the GTA and areas surrounding it.

The three urban structure concepts which have been developed for this purpose are described more fully in Background Report No. 1: Description of Urban Structure Concepts. Their main characteristics are as follows:

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3. an intermediate concept in which the broad distribution of people and jobs is more similar to that of Concept 1 than of Concept 3, but in which growth occurs primarily in and around existing communities in a compact form, resulting in a reduction in the rate of consumption of undeveloped land relative to Concept 1 (designated as **Concept 3, Nodal**).

The reader is directed to Background Report No. 1 for a more complete description of the three concepts and to Background Report No. 2: Minimal Growth Concept, for a discussion of possible government regulations to retard or limit the overall growth of the GTA.

1.2 OBJECTIVES AND SCOPE OF THIS REPORT

The objective of this report is to provide a systematic comparison of the three urban structure concepts in terms of the following:

- transportation;
- hard services (water, sewer, solid waste management);
- greening/environment;
- human services.

Infrastructure Requirements

Infrastructure system concepts were developed, as appropriate, for each of the three urban structure concepts and capital cost estimates were prepared for each, along with quantitative or qualitative assessments of operating costs, focusing in particular on differences among the three concepts.

Other Basic Issues

A number of important issues are also addressed in the comparison, to augment the above infrastructure/cost comparison, including the following:

- urban structure;
- economic impetus;
- environmental quality;
- energy consumption;
- external impacts;
- other quality of life factors.

The comparison was conducted at a broad, strategic level, presenting the results as objectively as possible and in a systematic manner as a basis for readers to draw their own conclusions regarding the advantages and disadvantages of each concept in terms of each criterion or issue being considered. In accordance with the terms of reference, no attempt was made to provide an overall "bottom line" evaluation regarding whether one concept is "better" than another, since conclusions of this type and decisions based on them require discussion and consensus in a broader form.

2. COMPARISON CRITERIA, FACTORS AND MEASURES

Eight criteria were defined for the comparison, as follows:

1. urban structure;
2. economic impetus;
3. transportation;
4. hard services;
5. greening/environment;
6. human services;
7. external impacts;
8. overall infrastructure costs.

As shown in Exhibit 1, a number of factors were defined under the various criteria and, within each factor, one or more measures were developed as a basis for describing and expressing differences among the three urban structure concepts.

In the remainder of this chapter we describe the various factors and measures used to assess the extent to which each concept is rated positively or negatively in terms of each criterion. Metric units are generally used in this report, except that population densities are presented and discussed in terms of people per acre and other imperial measures are used where the data were available in those units. A similar mixture of metric and imperial units is used in the other background reports, based on discussions with the Urban Structure Subcommittee, such that units in common usage (such as people per acre, dwelling units per acre and gallons per day) are used there as appropriate. Metric/Imperial conversions are provided in the text but not in the exhibits owing to space limitations in the latter.

2.1 URBAN STRUCTURE

1.1 Amenities and Diversity:

- Has a moderate **impact on existing community character**, e.g. size and density.
- Helps to provide a **range of community sizes**.
- Helps to provide a **range of community diversity** in terms of the types and mix of housing, employment, human services and recreation.

EXHIBIT 1
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON CRITERIA, FACTORS AND MEASURES

CRITERIA	FACTORS	MEASURES
1. Urban Structure	1.1 Amenities and diversity	• Low impact on existing community character • High range of community sizes • High range of community diversity
	1.2 Integration and efficiency	• High utilization of existing infrastructure • High regional/local balance of people and jobs
2. Economic Impetus	2.1 Economic growth opportunities	• Low risk of land price increases due to government regulation • Low land development costs which contribute to economic efficiency
	2.2 Impact on Agriculture	• Low encroachment on agricultural land
	2.3 Impact on Natural Resources	• Low impact on forest resources • Low impact on mineral resources
3. Transportation	3.1 Choice of modes and service levels	• High transit accessibility and service level • High road accessibility and service level • High effectiveness of intercity connections • High population accessibility to rural areas
	3.2 Transportation efficiency/costs	• Low average trip times, distances and costs • High proportion of each Region's work trips remain in the Region • High transit efficiency and cost recovery • Reduced road traffic congestion growth • Reduced requirements for school busing • Better opportunity to provide transit for handicapped persons • Low transportation capital costs • Low transportation operating costs
4. Hard Services	4.1 Trunk water and sanitary sewage systems	• Low water/sewer trunk costs
	4.2 Solid waste management	• Low costs for solid waste disposal systems
	4.3 Land development and redevelopment	• Low capital costs for land development and redevelopment re local services
5. Greening/Environment	5.1 Greening	• High compatibility with regional greenlands concept • High available amount of passive open space (eg. river valleys and conservation areas) • High ease of disposal of contaminated soils • High potential for cleanup of contaminated soils
	5.2 Sustainable development	• High potential for improving quality of stormwater drainage • Reduced atmospheric quality degradation (eg. low transportation emissions) • Low level of transportation energy consumption
6. Human Services	6.1 Level of service, accessibility, efficiency and capital costs of human services	• Effectiveness/efficiency of health services • Effectiveness/efficiency of education services • Effectiveness/efficiency of cultural and recreational services • Effectiveness/efficiency of social services • Effectiveness/efficiency of protection services
7. External Impacts	7.1 Nature/extent of impacts on the adjacent hinterland	• Low pressure for overspill development • Low growth of GTA oriented road traffic
8. Overall Infrastructure Costs	8.1 Capital Costs	• Low overall transportation, hard services, greening/environment and human services capital costs
	8.2 Operating Costs	• Low operating costs • Human services operating cost implications

1.2 Integration and Efficiency:

- Compact development in and adjacent to established urban communities **builds on existing urban infrastructure** and helps protect rural areas.

- Provides a **regional and local balance of people and jobs,** by type, to help reduce commuting distances.

2.2 ECONOMIC IMPETUS

2.1 Economic Growth Opportunities:

- Helps to maintain a **high rate of delivery of serviced land** thereby moderating the risk of price increases for housing and economic activities;

- Helps to **reduce per capita land development costs** thereby contributing to economic efficiency.

2.2 Impact on Agriculture:

- Has **low encroachment onto Class 1, 2 and 3 agricultural land.**

2.3 Impact on Natural Resources:

- Has **low impact on forest resources** in the GTA.

- Has **low impact on mineral resources** in the GTA.

2.3 TRANSPORTATION

3.1 Choice of Modes and Service Levels:

- Provides **high transit accessibility and level of service.**

- Provides **high road accessibility and level of service.**

- Provides **high effectiveness of external (intercity) connections and access to intercity terminals.**

- Provides **high accessibility for the urban population to reach rural and vacation areas.**

3.2 Transportation Efficiency/Costs:

- Has **low average trip times, distances and costs.**

- **A high proportion of each region's work trips remain in the region.**

- Local and intercommunity **trips can be served efficiently by public transit with relatively high cost recovery from the fare box.**

- Urban structure **reduces pressures for continuing growth of road traffic congestion.**

- Has **reduced requirements for school busing.**

- Allows **more opportunity to provide transit services for mobility-handicapped persons.**

- Required transportation improvements have a **relatively low capital cost.**

- The resulting transportation system has a **relatively low operating cost.**

2.4 HARD SERVICES

4.1 Trunk Water and Sanitary Sewerage Systems:

- Has **relatively low capital cost to expand trunk water and sewerage systems.**

4.2 Solid Waste Management:

- Has **relatively low costs to provide and operate solid waste disposal systems.**

4.3 Land Development and Redevelopment:

- Has **relatively low capital costs for land development and redevelopment and local hard services** including site preparation, water/sewer services, roads, sidewalks, street lighting and electric power utilities.

2.5 GREENING/ ENVIRONMENT

5.1 Greening:

- **High compatibility with the regional "greenlands" concept.**

- Has **high available amount of passive open space** (e.g. river valleys and conservation areas).

- Relative **ease of disposal of contaminated soils.**

- Relative **potential for cleanup of contaminated soils.**

5.2 Sustainable Development:

- Relative **potential for improving the quality of storm water drainage**.
- **Reduced degradation of atmospheric quality** (as measured by relatively low transportation emissions).
- **Low level of transportation energy consumption.**

2.6 HUMAN SERVICES

6.1 Level of Service, Accessibility, Efficiency and Capital Costs of Human Services:

- **Effectiveness/efficiency of health services.**
- **Effectiveness/efficiency of education services.**
- **Effectiveness/efficiency of cultural and recreational services.**
- **Effectiveness/efficiency of social welfare and protection services.**
- **Effectiveness/efficiency of protection services.**

2.7 EXTERNAL IMPACTS

7.1 Nature and Extent of Impacts on Adjacent Hinterland:

- **Low pressure for overspill urban development.**
- **Low growth of GTA-oriented road commuting traffic.**

2.8 OVERALL INFRASTRUCTURE COSTS

8.1 Capital Costs:

- **Relatively low overall transportation, hard services, greening/environment and human services capital costs.**

8.2 Operating Costs:

- **Relatively low transportation operating costs.**
- **Human services operating cost implications.**

The manner in which these criteria, factors and measures are applied for comparison purposes, and the results obtained, are described in the next chapter.

3. COMPARISON, APPROACH AND RESULTS

3.1 APPROACH

The approach taken in developing and presenting the comparison results was to prepare two basic comparison tables or arrays, as follows:

1. **Comparison Measures Table**: a tabular array showing for each of the three urban structure concepts the facts, quantitative measures and/or qualitative comments describing how each concept is rated in terms of each of the criteria/measures outlined in the previous chapter. This is meant to provide a basic set of comparative information on each of the three concepts, with as much factual content as possible based on the analysis, but also including qualitative judgement where appropriate and necessary;

2. **Comparison Summary Table**: an array in the same format as the above table, but using a graphical approach to indicate that one concept appears to be superior to another in terms of each specific measure. As indicated earlier, no attempt is made in this array to provide a "bottom line" overall comparison, since this would require further value judgements regarding the relevant weighting of the various criteria and measures, and this is a process which requires broader input of the community and its political representatives.

3.2 COMPARISON MEASURES TABLE

Exhibit 2 presents the Comparison Measures Table, on a multi-page format reflecting the substantial amount of information presented. The reader is referred to the companion background reports for more detail on the facts and reasoning behind the comparisons presented in this table.

In comparing the three urban structure concepts, in terms of each criterion, factor and measure, a five point rating index is used: "**high**", "**medium-high**", "**medium**", "**medium-low**" and "**low**". In all cases the comparison measures have been stated such that a "high" rating is seen as desirable and a "low" rating is seen as undesirable. The remainder of this section outlines the comparison reasoning and results presented in Exhibit 2.

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
1. URBAN STRUCTURE

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
1.1 Urban amenities and diversity	Has **low impact on existing community character** in term of traffic growth, increased density, noise levels, neighbourhood disruption and other growth-related impacts. (Low impact = High rating)	**Medium:** Continuation of low density suburban development is "more of the same" but produces increasing auto traffic dependency and congestion with resulting community disruption.	**Medium:** Suburban growth pressures are relieved but central redeveloped areas are subject to change as population densities are increased.	**Medium-High:** Suburban traffic pressures are relieved by greater use of transit and more moderate growth rates. Nodalized redevelopment in central areas localizes the areas of densification impact.
	Helps provide a **high range of community sizes** with clear demarkation between communities by green separators.	**Low:** Spread city tends to create amorphous urbanization without clearly delineated communities, so all communities become "large".	**Medium:** Slower suburban growth allows existing suburban communities to retain their identity and range of sizes without growing together. Less community identity and size range in central areas because of major population growth there.	**High:** Nodes provide a range of community sizes in both suburban and central areas, with green urban separators in suburbs providing community demarkation and allowing a range of community sizes to be retained.
	Helps provide a **high range of community diversity** in terms of housing types and ownership, densities, mixes of residential and employment activities.	**Medium-Low:** Spread city has delivered a prepondence of single-detached houses of similar sizes and ownership characteristics with subdivisions and shopping centres displaying great similarity. A trend to greater diversity is possible if sufficient political will exists.	**Medium:** Reduced suburban growth pressures and greater central residential redevelopment can provide a greater range of community diversity in terms of densities, types and sizes of housing, mix of population and employment.	**High:** Nodes can provide a range and choice at housing types, sizes, densities and diverse mixes of population and employment, enabled by redevelopment in both suburban and central communities and compact development on new suburban land.
1.2 Urban integration and efficiency	**Has high utilization of existing urban infrastructure** such as municipal buildings, human services facilities, transportation, hard services and social networks.	**Medium-Low:** Some growth on new land contiguous to existing communities achieves this but much of spread city must build urban infrastructure and services from the ground up.	**Medium-High:** Makes maximum use of inner city schools, hospitals, water/sewer, transit and human services while reducing the expense of creating urban infrastructure on new land.	**Medium:** Achieves efficient use of existing facilities by building on existing communities, but lower central growth than under Concept 2 achieves less of this in central, built-up areas.
	Has a **high balance of people and jobs in each region and community.**	**Low:** Continuing suburban population growth and central area job growth exacerbates the separation of workers and jobs. Existing zoning tends to separate land uses.	**High:** Achieves the best balance of people and jobs in each region because high population growth in central areas better balances continuing job growth there and leaves better suburban balance also.	**Medium-High:** Has intermediate level of people/job balance at "macro" scale but achieves good mix at local (nodal) level.

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
2. ECONOMIC IMPETUS

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
2.1 Economic growth opportunities	Low level of government regulation **helps to maintain a high rate of delivery of serviced land** for residential and employment purposes, thereby **moderating the risk of price increases**.	**Medium-High:** Has proven ability to deliver serviced land and housing but delivery rates have fallen behind rapid growth in demand from time to time, producing major price increases.	**Medium-Low:** Government regulation to redirect population growth increases risk of supply/demand imbalance and resulting price increases.	**Medium:** Less government regulation than in Concept 2 reduces risk of price increases due to supply/demand imbalance.
	Low consumption of new land helps to **reduce per capita land development costs** and thereby moderate price increases for land, housing and employment facilities.	**Low:** Has relatively high residential land development costs, due to more consumption of new land. $3,000-4,000 per new resident	**High:** Has relatively low land development costs, due to less consumption of new land. $1,000-1,500 per new resident	**Medium:** Intermediate levels of residential land consumption and land development costs. $2,000-3,000 per new resident
2.2 Impact on Agriculture	**Has low encroachment on agricultural land**	**Low:** An additional 213 sq. miles of agricultural land would be consumed.	**Medium-High:** An additional 45 sq. miles of agricultural land would be consumed.	**Medium:** An additional 112 sq. miles of agricultural land would be consumed.
2.3 Impact on Natural Resources	**Has low impact on forest resources**	**Low:** An additional 27 sq. miles of forest covered land would be within the urban envelope	**Medium-High:** An additional 15 sq. miles of forest covered land would be within the urban envelope.	**Medium:** An additional 20 sq. miles of forest covered land would be within the urban envelope.
	Has low impact on mineral resources	**Low:** Some 13 sq. miles of mineral resource areas would be located within the urban envelope.	**Medium-High:** About 3 sq. miles of mineral resource areas would be located with the urban envelope.	**Medium-Low:** About 8 sq. miles of mineral resource areas would be within the urban envelope.

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
3. TRANSPORTATION

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
3.1 Choice of modes and service levels	**High transit accessibility and service level.**	**Low:** Low concentration impedes effective provision of transit service. Fewer rapid transit facilities are constructed. Improved Commuter Rail: 410 km New Rapid Transit: 81 km	**High:** More intensive network of public transit services available. Improved Commuter Rail: 360 km New Rapid Transit: 178 km	**Medium:** Good range of public transit available within and between communities. Improved Commuter Rail: 410 km New Rapid Transit: 181 km
	High road accessibility and service level	**High:** Extensive network of freeways and arterials. Freeways: 2,035 lane-km Arterials: 5,237 lane-km	**Low:** Limited expansion of road system. Freeways: 784 lane-km Arterials: 3,908 lane-km	**Medium:** Intermediate expansion of existing road system. Freeways: 1,024 lane-km Arterials: 5,472 lane-km
	The urban form and transportation concept contributes to **high effectiveness of intercity connections and access to intercity terminals**	**Medium-High:** Airport(s) well served by Freeway system; other intercity connections less well served.	**Medium:** Terminals accessible by rapid transit but road congestion more likely.	**Medium:** Reasonable connections to terminals by roads and transit.
	High population accessibility to rural areas	**Medium-High**: More extensive road system better able to carry recreational traffic; relatively poor transit access	**Medium-Low:** Greater likelihood of road congestion under recreational peaks; possibly greater propensity per capita to visit rural areas because of higher urban population density. Better transit access.	**Medium:** Intermediate levels, between the other two concepts, of likely road congestion and travel propensity to rural areas. Transit access similar to that of Concept 2.
3.2 Transportation efficiency/costs	**Low average trip times, distances and costs** (in the a.m. peak hour)	**Low:** Longer trips, higher costs, more auto trips. Auto / Transit / Total Avg. time/ trip (min): 20.6 / 48.5 / 27.5 Avg. distance/ /trip (km): 14.9 / 15.2 / 15.0 Avg. cost/ trip ($): 3.73 / 1.41 / 3.15 Person-hours of travel (M): .243 / .142 / .385 Person-km of travel (M): 11.86 / 5.13 / 16.99	**High:** Shorter trips, lower costs. Auto / Transit / Total Avg. time/ trip (min): 19.8 / 31.9 / 24.7 Avg. distance/ /trip (km): 13.9 / 11.8 / 13.2 Avg. cost/ trip ($): 3.48 / 1.25 / 2.70 Person-hours of travel (M): .204 / .164 / .368 Person-km of travel (M): 8.77 / 5.66 / 14.42	**Medium:** Shorter trips within nodes. Auto / Transit / Total Avg. time/ trip (min): 20.3 / 38.8 / 26.5 Avg. distance/ /trip (km): 14.4 / 14.2 / 14.3 Avg. cost/ trip ($): 3.60 / 1.47 / 2.99 Person-hours of travel (M): .230 / .151 / .381 Person-km of travel (M): 10.74 / 5.37 / 16.11

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
3. TRANSPORTATION (CONT'D)

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
3.2 Transportation efficiency/costs (CONT'D)	**High proportion of each Region's trips remain in the Region**	**Low:** Considerable cross commuting between regions. Intra-regional 70% 4 regions to Metro 17% Metro to 4 regions 7% Among 4 regions 5%	**High:** Many more trips entirely within each region. Intra-regional 78% 4 regions to Metro 10% Metro to 4 regions 9% Among 4 regions 3%	**Medium:** Nodal concentrations encourage local movements. Intra-regional 73% 4 regions to Metro 15% Metro to 4 regions 8% Among 4 regions 4%
	High transit efficiency and cost recovery	**Low:** Spread development difficult to serve by public transit.	**High:** Concentration of population and employment permits economic provision of public transit service.	**Medium:** Nodal concentration can be served but long distances between nodes increase transit costs.
	Reduced road traffic congestion growth	**Medium:** All three transportation concepts are sized and costed to provide the same level of service for road traffic (ie. travel speeds similar to those in 1986).	**Medium:** All three transportation concepts are sized and costed to provide the same level of service for road traffic (ie. travel speeds similar to those in 1986).	**Medium:** All three transportation concepts are sized and costed to provide the same level of service for road traffic (ie. travel speeds similar to those in 1986).
	Reduced requirements for school busing (in 2021, annual cost in billions of 1990 dollars)	**Low:** Extensive school busing required throughout low density suburbs. School bus operating costs: $0.27	**High:** Intensified population in central areas means many more students would be able to walk or take regular transit to school. School bus operating costs: $0.17	**Medium-High:** Many students would be able to walk or take transit to school within and between nodes. School bus operating costs: $0.22
	Better opportunity to provide transit for handicapped persons and lower operating costs (in 2021, annual cost in billions of 1990 dollars)	**Medium:** More roads for paratransit but less opportunity to make new transit facilities handicapped-accessible. Handicapped transit operating costs: $0.17	**High:** Shorter trips and more opportunity to make new transit facilities handicapped-accessible. Handicapped transit operating costs: $0.14	**Medium-High:** Intermediate trip lengths but good opportunities to make new transit facilities handicapped-accessible. Handicapped transit operating costs: $0.17
	Low transportation capital costs (billions of 1990 dollars)	**Medium:** Similar total capital cost: Roads: $ 19.93 Transit: $ 7.16 Total: $27.09	**Medium:** Similar total capital cost: Roads: $13.20 Transit: $14.41 Total: $27.61	**Medium:** Similar total capital cost: Roads: $17.04 Transit: $11.58 Total: $28.62
	Low transportation operating costs for roads and transit operations (billions of 1990 dollars)	**Low:** Highest operating cost: Roads: $0.24 Transit: 1.13 Road User: 10.15 Total: $11.52	**High:** Lowest operating cost: Roads: $0.21 Transit: 1.37 Road User: 7.98 Total: $9.56	**Medium:** Intermediate operating cost: Roads: $0.23 Transit: 1.32 Road User: 9.15 Total: $10.70

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
4. HARD SERVICES

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
4.1 Trunk water and sanitary sewerage systems	**Low capital costs to expand trunk water and sanitary sewerage systems**	**Medium:** Estimated capital cost is $3.7 billion	**Medium:** Estimated capital cost is $3.7 billion	**Medium:** Estimated capital cost is $3.7 billion
4.2 Solid waste management	**Low costs to provide and operate waste disposal systems**	**Medium:** Relative annual 2021 operating costs are essentially the same in the three concepts: $0.77 billion for centralized waste management system; $1.00 billion for decentralized system. Life cycle costs are also the same at $5.9 billion for a centralized waste management system or $7.7 billion for a decentralized system.	**Medium:** Relative annual 2021 operating costs are essentially the same in the three concepts: $0.77 billion for centralized waste management system; $1.00 billion for decentralized system. Life cycle costs are also the same at $5.9 billion for a centralized waste management system or $7.7 billion for a decentralized system.	**Medium:** Relative annual 2021 operating costs are essentially the same in the three concepts: $0.77 billion for centralized waste management system; $1.00 billion for decentralized system. Life cycle costs are also the same at $5.9 billion for a centralized waste management system or $7.7 billion for a decentralized system.
4.3 Land development and redevelopment	**Low capital costs for land development and redevelopment, site preparation and local services**	**Low:** Estimated capital cost is highest: $15.8 billion	**High:** Estimated capital cost is lowest: $9.0 billion	**Medium-High:** Estimated capital cost is intermediate but closer to that of Concept 2: $11.0 billion

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
5. GREENING/ENVIRONMENT

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
5.1 Greening	**High compatibility with regional greenlands concept**	**Low:** An additional 35 sq. miles of the Oak Ridges Moraine area and 10 miles of the Lake Ontario waterfront would be within the urban envelope.	**High:** An additional 10 sq. miles of the Oak Ridges Moraine area and 4 miles of the Lake Ontario waterfront would be within the urban envelope.	**Medium:** An additional 20 sq. miles of the Oak Ridges Moraine area and 6 miles of the Lake Ontario waterfront would be within the urban envelope.
	High available amount of passive open space (eg. river valleys and conservation areas)	**High:** About 4 acres per 1,000 people would be available. To meet the current rate of 4.4 acres per 1,000 people some 2,200 acres would be required at an approximate cost of $1.1 billion.	**Low:** About 3.1 acres per 1,000 people would be available. To meet the current rate of 4.4 acres per 1,000 people some 8,000 acres would be required at an approximate cost of $6 billion or residents would travel farther to open space if spend $1.1 billion for 2,200 acres as in Concept 1.	**Medium-Low:** About 3.2 acres per 1,000 people would be available. To meet the current rate of 4.4 acres per 1,000 people some 7,500 acres would be required at an approx. cost of $4.7 billion or residents would travel farther to open space if spend $1.1 billion for 2,200 acres as in Concept 1.
	High ease of disposal of contaminated soils	**Medium-High:** About 2,750 acres of urban redevelopment is involved which should result in lower quantities of contaminated soil.	**Low:** About 11,000 acres of urban redevelopment is involved and the quantities of contaminated soils would be higher than in the other concepts.	**Medium:** About 4,750 acres of urban redevelopment is involved. More contaminated soil than Concept 1 is likely, but less than Concept 2.
	High potential for cleanup of contaminated soils	**Medium-Low:** The lower densities and amounts of redevelopment present less economic potential for cleaning up contaminated soils in existing urban areas.	**Medium-High:** The higher densities and amounts of redevelopment may make the clean-up of contaminated soils more economically viable.	**Medium:** Clean-up of contaminated soils may be more economically viable than in Concept 1, but would not be as viable as in Concept 2, reflecting intermediate amounts and densities of redevelopment.

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
5. GREENING/ENVIRONMENT (CONT'D)

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
5.2 Sustainable development	**Has high potential for improving quality of stormwater drainage**	**Medium-Low:** This concept presents less potential for retrofitting the existing urban area, to improve stormwater drainage quality.	**Medium-High:** This concept presents the highest potential for retrofitting the existing urbanized area.	**Medium:** This concept presents less potential for retrofitting the existing urbanized area than Concept 2, but has more potential than Concept 1.
	Reduced atmospheric quality degradation (eg. transportation emissions in the a.m. peak 3 hours)	**Low:** Greatest emission level: 5,245,000 kg	**High:** Lowest emission level: 2,602,000 kg	**Medium:** Intermediate emission level: 2,958,000 kg
	Low level of transportation energy consumption (eg. transportation energy consumed in the a.m. peak 3 hours)	**Low:** Greatest energy consumption: 46,683,000 MJ	**High:** Lowest energy consumption: 37,239,000 MJ	**Medium:** Intermediate energy consumption: 42,074,000 MJ

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
6. HUMAN SERVICES

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
6.1 Level of service, accessibility, efficiency and capital costs of human services	**Effectiveness/efficiency of health services**	**Medium:** Least efficient utilization of existing hospitals and most duplication of services and facilities; least efficient delivery of community-based non-institutional services; greatest travel distance to obtain specialized services, but lowest capital costs for hospitals. Capital Cost Estimates ($ Billions) @ 3.5 beds/1,000: $4.45 @ 3.0 beds/1,000: $3.69	**Medium-High:** Highest utilization of existing hospitals and highest level of service to aging population and referrals to specialized services; greatest opportunity for rationalization of services and facilities; most efficient delivery of community-based primary/non-institutional services; most efficient travel distance to obtain specialized services. Capital Cost Estimates ($ Billions) @ 3.5 beds/1,000: $5.56 @ 3.0 beds/1,000: $4.65	**Medium:** Potential for rationalization within areas served by nodes; efficient delivery of community-based non-institutional services; potential for deconcentration of a wider range of specialized services to nodes. Capital Cost Estimates ($ Billions) @ 3.5 beds/1,000: $4.75 @ 3.0 beds/1,000: $3.93
	Effectiveness/efficiency of education services	**Medium-Low:** Greater travel distances; less efficient utilization of primary facilities; greater potential for inefficiencies from duplication; less efficient specialization; highest demand for new construction, highest capital cost. Capital Cost Estimates ($ Billions) Elem. & High Schools: $4.71 Colleges & Universities: $1.69 Total: $6.40	**Medium-High:** Most efficient travel patterns; most opportunity for rationalization and efficient specialization; best re-utilization of existing primary classroom capacity, therefore least capital cost; highest utilization of existing (expanded) colleges and universities. Capital Cost Estimates ($ Billions) Elem. & High Schools: $2.33 Colleges & Universities: $1.87 Total: $4.20	**Medium:** Intermediate travel distances; potential for efficient use of integrated primary and secondary facilities. Capital Cost Estimates ($ Billions) Elem. & High Schools: $3.01 Colleges & Universities: $1.78 Total: $4.79

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
6. HUMAN SERVICES

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
6.1 Level of service, accessibility, efficiency and capital costs of human services (CONT'D)	**Effectiveness/efficiency of cultural and recreational services**	**Medium-High:** Highest space standards; least potential for economies of scale and efficiencies from shared, integrated services and facilities; least accessibility; but lower land costs. Capital Cost Estimates ($Billions) General Cult./Rec. $10.90 Parks (Land) 2.32 Total $13.22	**Medium-Low:** Lowest space standards; maximum use of existing facilities; high utilization of facilities, and potential for efficient integration; highest accessibility; but higher land costs. Capital Cost Estimates ($Billions) General Cult./Rec. $10.90 Parks (Land) 4.22 Total $15.12	**Medium-High:** Moderate space standards and good potential utilization; opportunity for rationalization of services and facilities development; moderate land costs; good regional accessibility. Capital Cost Estimates ($Billions) General Cult./Rec. $10.90 Parks (Land) 2.82 Total $13.72
	Effectiveness/efficiency of social services	**Medium-Low:** Least efficient accessibility; least efficient community-based service delivery; least specialization; lowest overall level of service. Capital Cost Estimates ($Billions) Soc/Other Health Services $2.68	**Medium:** Effective use of existing service agency network as delivery base; highest accessibility; highest potential for efficient specialization but less potential for integration and collaboration effecting overall level of service. Capital Cost Estimates ($Billions) Soc/Other Health Services $2.68	**Medium-High:** Potential to build effective community-based political will to support funding and delivery; reasonable accessibility; highest potential for rationalization and collaboration to achieve efficiencies and higher overall levels of service. Capital Cost Estimates ($Billions) Soc/Other Health Services $2.68
	Effectiveness/efficiency of protection services	**Medium-Low:** Low potential service levels due to longest travel distances and least efficient distribution of facilities. Capital Cost Estimates ($Billions) Protection $2.83	**Medium:** Least travel distances but slower travel times due to greater potential for conflicts in central areas. Capital Cost Estimates ($Billions) Protection $2.83	**Medium-High:** Highest potential service levels due to efficient circulation patterns and response times. Capital Cost Estimates ($Billions) Protection $2.83

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
7. EXTERNAL IMPACTS

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
7.1 Nature/extent of impacts on the adjacent hinterland	**Low pressure for urban overspill development**	**Low:** Spread, low density suburban development moves urbanization closer to GTA rural boundaries and increases pressure for overspill development in adjacent areas.	**Medium:** Preservation of farm land in presently rural parts of GTA and containment of suburban development areas reduces pressure for overspill development, provided that supply and demand of residential land are kept in balance so that housing prices do not increase unduly.	**Medium:** More suburban growth than in Concept 2 but less pressure for overspill development because of more compact development, subject to the same condition as noted for Concept 2 regarding housing prices.
	Low growth of GTA oriented road traffic	**Low:** High dependence on private automobile transportation, coupled with overspill development, leads to growth of road commuting traffic across the GTA boundary and on the exurban road system.	**Medium-Low:** Greater use of public transit, lower auto use/ownership and less overspill development create less pressure for exurban auto commuting traffic, but there could be greater pressure for recreational traffic to rural/vacation areas, and auto would likely persist as the major mode for such travel.	**Medium-High:** Similar to Concept 2 but greater suburban development, a larger road network and less reliance on public transit indicate an intermediate level of exurban road traffic growth with possibly less pressure for rurally-oriented recreational traffic than under Concept 2. Nodal development favours better rail service to suburban and exurban centres, which also helps to relieve auto traffic growth pressure.

EXHIBIT 2
GTA URBAN STRUCTURE CONCEPTS STUDY
COMPARISON MEASURES TABLE
8. OVERALL INFRASTRUCTURE COSTS

CRITERIA & FACTORS	COMPARISON MEASURES	CONCEPT 1: SPREAD	CONCEPT 2: CENTRAL	CONCEPT 3: NODAL
8.1 Capital Costs	**Low overall transportation, hard services, greening/environment and human services capital costs** (cumulative: 1990-2021, measured in billions of 1990 dollars)	**Medium:** Similar total capital costs: Transportation: $27.09 Hard Services: 19.48 Greening/Environment: 3.10 Human Services: 29.58 Total Capital Cost: $79.25	**Medium:** Similar total capital costs: Transportation: $27.61 Hard Services: 12.66 Greening/Environment: 3.10-8.00 Human Services: 30.39 Total Capital Cost: $73.76-78.66	**Medium:** Similar total capital costs: Transportation: $28.62 Hard Services: 14.72 Greening/Environment: 3.10-6.70 Human Services: 28.77 Total Capital Cost: $75.21-78.81
8.2 Operating Costs	**Low operating costs** (annual operating costs in 2021, measured in billions of 1990 dollars)	**Low:** Has highest transportation operating costs, in total: Roads & Auto Travel: $10.39 Transit: 1.13 School Bus: 0.27 Handicapped Transit: 0.17 Total: $11.95	**High:** Has lowest transportation operating costs in total: Roads & Auto Travel: $8.19 Transit: 1.37 School Bus: 0.17 Handicapped Transit: 0.14 Total: $9.87	**Medium:** Has intermediate level of transportation operating costs in total: Roads & Auto Travel: $9.38 Transit: 1.32 School Bus: 0.22 Handicapped Transit: 0.17 Total: $11.08
	Human services operating cost implications	**Medium-Low:** Has least efficient delivery and highest operating costs would be anticipated (they were not quantified) because of lower densities, longer travelling distances for servers and clients, less opportunity to provide combined, integrated services at hub locations.	**Medium-High:** Most efficient delivery, lowest operating costs and travel distances, greatest integration of services and facilities would be anticipated.	**Medium-High:** Travel distances are longer, on average than those in Concept 2 but nodal communities would allow easy access and integrated, efficient delivery of services.

CRITERION 1: URBAN STRUCTURE

Factor 1.1: Urban Amenities and Diversity

Low Impact on Existing Community Character

A concept is given a **high** rating under this measure if it tends to have a low impact on existing community character in terms of traffic growth, increased density, noise levels, neighbourhood disruption and other growth-related impacts. Concept 1, Spread, is given a **medium** rating because, while there would be little change in density, the relatively high auto traffic dependency of this concept would lead to increasing traffic penetration and community disruption. Concept 2, Central, is also given a **medium** rating because, while suburban growth pressures would be relieved, there would be density changes in redevelopment areas within the central, built-up areas. It should be noted, however, that the types of major redevelopment areas identified in this study (see Background Report No. 1) have existing uses which are mainly industrial, institutional or transportation oriented, such that redevelopment would not have to involve significant redevelopment of existing residential areas. Concept 3, Nodal, is given a **medium-high** rating because suburban automobile traffic pressures would be relieved by a greater use of transit and more moderate growth rates, while nodalized redevelopment in central areas and existing communities would tend to localize the areas of densification impact.

High Range of Community Sizes

A concept has a **high** rating under this measure if it helps to provide a range of community sizes with clear demarcation between the communities by green separators. Concept 1, Spread, is given a **low** rating because it tends to create amorphous urbanization without clear delineation by green separators between the communities, such that all communities merge together and become "large". Concept 2, Central, is given a **medium** rating because slower suburban growth would allow existing suburban communities to retain their identity and range of sizes without as great a tendency to grow together as would be the case under Concept 1. There would, however, be less community identity and size range in central areas because of the major population growth there. Concept 3, Nodal, is given a **high** rating because the nodes would provide a range of community sizes in both suburban and central areas and an opportunity to delineate them with green urban separators in the suburbs, thereby allowing a range of community sizes to be retained.

High Range of Community Diversity

A concept has a **high** rating under this measure if it helps provide a range of community diversity in terms of housing types and ownership (e.g. rental, owned), densities, and mixes of residential and employment activities. Concept 1, Spread, is given a **medium-low** rating because, based on past and current performance, it tends to deliver a preponderance of single-detached houses of similar sizes and ownership characteristics, with subdivision and shopping centres displaying great similarity. A trend to greater diversity could be possible under this concept if sufficient political will were exerted, but there are economic pressures on area municipal governments to continue with the existing mode of development. Concept 2, Central, is given a **medium** rating because reduced suburban growth pressures and greater central residential redevelopment can provide a greater range of community diversity in terms of densities, types and sizes of housing, and mix of population and employment. Concept 3, Nodal, is given a **high** rating because the nodes can provide a range and choice of housing types, sizes, densities and diverse mixes of population and employment through a combination of redevelopment and compact development in both suburban and central communities.

Factor 1.2: Urban Integration and Efficiency

High Utilization of Existing Infrastructure

A concept is given a **high** rating under this measure if it builds on existing urban infrastructure such as municipal buildings, human services facilities, transportation, hard services and social networks. Concept 1, Spread, is given a **medium-low** rating because, while some growth on new land is contiguous to existing communities and would help to achieve these objectives, most of the low density suburban development would be relatively remote from existing communities and would have to build urban infrastructure and services from the ground up. Concept 2, Central, is given a **medium-high** rating because it would make maximum use of inner city schools, hospitals, water/sewer, transit and human services while reducing the extent of creating urban infrastructure on new land. Concept 3 is given a **medium** rating because, while it would achieve efficient use of existing facilities by building on existing communities, it would achieve this less in central areas than would be the case under Concept 2, because of the lower population growth in such areas.

High Regional/Local Balance of People and Jobs

A concept is given a **high** rating under this measure if it achieves strong balance between the size of the residential population and the number of jobs in each region, such that there would be a balance between the numbers and skills of the resident labour force and the numbers and types of jobs available in the immediate communities, thereby reducing pressures for long commuting trips. Concept 1, Spread, is given a **low** rating because continuing suburban population growth and central area job growth would exacerbate the separation of workers and jobs through continuing development of "dormitory communities" and central employment areas. Concept 2, Central, is given a **high** rating because, as pointed out in Background Report No. 1, it would achieve the best balance of people and jobs in each region owing to the high population growth in central, built-up areas, accompanied by continuing employment growth in the suburban areas. Concept 3, Nodal, is given a **medium-high** rating because it would have an intermediate of people/job balance at the regional scale, but would achieve a good mix at the local (nodal) level.

CRITERION 2: ECONOMIC IMPETUS

Factor 2.1: Economic Growth Opportunities

Low Risk of Land Price Increases Due to Government Regulation

A concept is given a **high** rating under this measure if it would require a relatively low level of government regulation and has an existing process to maintain a high rate of delivery of serviced land for residential and employment purposes, thereby moderating the risk of price increases because of a supply/demand imbalance in the delivery of serviced land. Concept 1, Spread, is given a **medium-high** rating because it has a proven ability to deliver serviced land and housing; however, delivery rates of serviced land have tended to fall behind rapid growth and demand during the past six or seven years (and in earlier periods of rapid growth), producing major price increases in land and housing. Concept 2, Central, is given a **medium-low** rating because government regulation would be required to redirect significant population growth from suburban areas to central, built-up areas and this could increase the risk of supply/demand imbalance and resulting price increases. The challenge, under this concept, would be to ensure that the supply of land and housing, through redevelopment activities in central areas and a continuing, but reduced rate of development in suburban areas, would be sufficient to meet demand while providing lower levels of suburban development on new land than would be the case under Concept 1. Concept 3, Nodal, is given a **medium** rating because it would involve substantial levels of suburban development (although in

a more compact form) and therefore would likely require less government regulation than in Concept 2, thereby reducing the risk of price increases due to a supply/demand imbalance in the delivery of land and housing.

Low Land Development Costs Which Contribute to Economic Efficiency

A concept has a **high** rating under this measure if it has a low consumption of new land which helps to reduce per capita land development costs and thereby to moderate price increases for land, housing and employment facilities. Concept 1, Spread, has a **low** rating since most of the residential development and much of the employment development would take place on new land, with relatively high per capita land development costs ($3,000-4,000 per new resident) because of the low densities involved. Concept 2, Central, is given a **high** rating because it would have relatively low land development costs ($1,000-1,500 per new resident) due to less consumption of new land at low densities and more redevelopment at higher densities. Concept 3, Nodal, is given a **medium** rating because it would have intermediate levels of land consumption, densities and land development costs ($2,000-3,000 per new resident).

Factor 2.2: Impact on Agriculture

Low Encroachment on Agricultural Land

A concept has a **high** rating under this measure if the consumption of agriculture land (Class 1, 2 and 3) for urbanization is relatively low. Concept 1, Spread, has a **low** rating since an additional 213 sq. miles (552 km^2) would be consumed. Concept 2, Central, has a **medium-high** rating because the consumption of prime agricultural land would be considerably less, 45 sq. miles (117 km^2). Concept 3, Nodal has a **medium-high** rating also, since it would consume an additional 112 sq. miles (290 km^2) of agricultural land, very similar to that of Concept 2.

Factor 2.3: Impact on Natural Resources

Low Impact on Forest Resources

A concept has a **high** rating under this measure if its urbanized area consumes a relatively small amount of currently forested land. Concept 1, Spread, is given a **low** rating because an additional 27 sq. miles (70 km^2) of forest covered land would be within the urban envelope. Concept 2, Central, is given a **medium-high** rating because an additional 15 sq. miles (39 km^2) of forest covered land would be within the urban envelope, considerably less than under Concept 1. Concept 3, Nodal, is given a **medium** rating because an additional 20 sq. miles (52 km^2) of forest covered land would be

within the urban envelope, an intermediate level between that of the other two concepts.

Low Impact on Mineral Resources

A concept has a **high** rating under this measure if its urbanized area consumes a relatively small mineral resource area. In the case of the GTA, virtually all of the land defined in this way is devoted to producing aggregates, as discussed further in Background Report No. 5. Concept 1, Spread, is given a **medium-low** rating because some 13 sq. miles (34 km^2) of mineral resource areas would be located within the urban envelope. Concept 2, Central, is given a **medium-high** rating because about 3 sq. miles (8 km^2)of mineral resource areas would be located within the urban envelope. Concept 3, Compact, is given a **medium** rating because about 8 sq. miles (21 km^2)of mineral resource areas would be within the urban envelope.

CRITERION 3: TRANSPORTATION

Factor 3.1: Choice of Modes and Service Levels

High Transit Accessibility and Service Level

A concept is given a **high** rating under this measure if it provides a high level of transit accessibility (through the number and location of rapid transit and commuter rail lines combined with efficient feeder/ distributor services) and if the population and employment densities are such that high frequencies of services can be justified. Concept 1, Spread, is given a **low** rating since the low suburban densities would impede effective provision of transit service and would make it uneconomical to provide frequent service in many of the suburban areas. Concept 2, Central, is given a **high** rating because the high densities throughout the central, built-up area would justify the provision of a high level of public transit service and the strong balance between people and jobs in each region would promote relatively shorter work trips which can be well served by public transit and walking access. Concept 3, Nodal, is given a **medium** rating because, while densities are not as high as in Concept 2 and trips are longer, on average, the nodal urban structure would be highly compatible with providing efficient and effective transit service and trips within the nodes would be relatively short. Exhibit 2 lists the estimated route-km of improved commuter rail, and new rapid transit lines in the conceptual transit network developed and analyzed for each of the three urban structure concepts. It can be seen that Concepts 1 and 3 have relatively more km of improved GO services (reflecting greater suburban development) while

Concepts 2 and 3 have relatively more km of new rapid transit (reflecting greater reliance on transit). While not shown on the Exhibit, Concept 2 would have relatively more km of rail (as opposed to bus) rapid transit than Concept 3 and higher frequencies of service, to serve the higher population densities in central areas.

High Road Accessibility and Service Level

A concept is given a **high** rating under this measure if it provides substantially improved networks of major highways and arterial roadways for passenger and goods movements. Concept 1, Spread, is given a **high** rating because it would require and provide an extensive network of freeways and arterials. Concept 2, Central, is given a **low** rating because it would have a limited expansion of the road system. Concept 3, Nodal, is given a **medium** rating because it would involve an intermediate level of road system expansion. See Exhibit 2 for the estimated number of lane-km of freeways and arterial roads which would be added under the conceptual networks developed and analyzed for the three urban structure concepts, respectively. As shown, Concept 1 provides substantially more new freeways than Concept 2 and Concept 3 provides less, while Concepts 1 and 3 provides more arterial lane-km than Concept 2 does.

High Effectiveness of Intercity Connections

A concept is given a **high** rating under this measure if the urban form and transportation concept contributes to high effectiveness of intercity connections between residential and employment areas and major intercity terminals such as Pearson International Airport, Union Station and the intercity bus terminal, and if it provides relatively good road connections for those wishing to enter or leave the metropolitan area by automobile. Concept 1, Spread, is given a **medium-high** rating because the major airports and road access to and from the GTA would be well served by the freeway system and the other intercity connections would be somewhat less well served because of the lower transit accessibility. Concept 2, Central, is given a **medium** rating because, while all intercity terminals would be more accessible by public transit, the less extensive road network would be more susceptible to traffic congestion under conditions of peak recreational travel. Concept 3, Nodal, is also given a **medium** rating because, while it would provide better transit connections than would Concept 1, the road connections would not be as extensive.

High Population Accessibility to Rural Areas

A concept has a **high** rating under this measure if the transportation system and likely congestion levels are such that the urban population would have good accessibility to adjacent rural areas and recreational areas. Concept 1, Spread, is given a **medium-high** rating because it would have the most extensive road system, although the system would be subject to congestion pressures owing to the spread suburban development and there would be less transit to help provide

access to rural areas. Concept 2, Central, is given a **medium-low** rating because, while there would be better access by transit, there would be a greater likelihood of road congestion under recreational peaks and there might be a greater propensity to visit rural areas because of the higher urban population density. Concept 3, Nodal, is given a **medium** rating because it would have almost as much suburban development as under Concept 1 with a less extensive road network, although the higher densities and greater use of transit would help to relieve road congestion pressures and the urban population would have a greater choice of travel modes to reach rural and recreational areas beyond the urbanized area.

Factor 3.2: Transportation Efficiency and Costs

Low Average Trip Times, Distances and Costs

A concept has a **high** rating under these measures if it has low average travel times per trip, low average trip distance, and low average trip cost, as estimated for the a.m. peak hour in the travel simulations carried out under this study. These are described in Background Report No. 3: Transportation Systems. Person-km and person-hours of travel in the a.m. peak hour are also shown, as additional measures of travel effort. As indicated by the estimated average trip times, distances and costs shown for each concept in Exhibit 2, Concept 1, Spread, exhibits more travel effort under all three of these measures and is therefore rated **low**; Concept 2, Central, is rated **high** because of the shorter and less time consuming and costly trips under this intensified urban structure; Concept 3, Nodal, is rated **medium** because it displays an intermediate level of travel effort in terms of these measures.

High Proportion of Each Region's Work Trips Remain in the Region

A concept is rated **high** under this concept if a high proportion of the work trips generated by its residents remain within the region (i.e. have work places within the same region) rather than crossing a regional boundary to a more distant work place. Again, Exhibit 2 lists the percentage of total a.m. peak hour trips which are intra-regional (i.e. remain within the region of origin), the percentage which cross from one of the four suburban regions into Metro Toronto, the percentage which cross from Metro Toronto into one of the four regions, and the percentage which move from one of the four suburban regions to another, as estimated by the travel simulations conducted under this study. Based on these estimates, Concept 1, Spread, is given a **low** rating because there would be considerable cross-commuting between regions, adding to the person-km of demand which has to be accommodated by the transportation network. Conversely, Concept 2, Central, is given a **high** rating

because a considerably lower proportion of a.m. peak hour trips would cross from the suburban regions into Metro Toronto, and a high proportion would remain within each region. Concept 3, Nodal, is given a **medium** rating because it would generate an intermediate proportion of intra-regional and inter-regional trips. It should be noted that, while the travel simulations did not deal exclusively with work trips, a very high proportion of trips within the a.m. peak hour are to work destinations, which is why the simulated results are interpreted as applying primarily to work trips.

High Transit Efficiency and Cost Recovery

A concept is given a **high** rating under this measure if the density and distribution of population and employment are such that they can be served efficiently by transit, thereby achieving a high revenue/cost ratio for the transit services provided. Concept 1 is given a **low** rating because the spread, low density development in suburban areas is difficult to serve efficiently by public transit, such that service frequency, load factors and revenue/cost ratios tend to be low. Concept 2, Central, is given a **high** rating because the concentration of population and employment in central areas permits economic provision of a high level of public transit service which, in turn, attracts high ridership and achieves a higher revenue/cost ratio. Concept 3, Nodal, is given a **medium** rating because the nodal concentrations can be served very efficiently by transit but the relatively long distances between nodes are more costly to serve than for the shorter trips and services under Concept 2.

Reduced Road Traffic Congestion Growth

A concept is given a **high** rating under this measure if the combination of urban structure and its compatible transportation system are such that future rates of growth of road traffic congestion may be moderated. As described more fully in Background Report No. 3, the traffic demand analyses carried out under this study were designed such that the three transportation networks analyzed (one for each urban structure concept) each assumed an equal level of service as measured by the average travel speeds on the road system. In simulating each network, this was achieved by assuming recently measured (1986) travel speeds on all road links. The new road links added in each network were assumed to have travel speeds compatible with the 1986 speeds on existing links, while new transit links were assumed to have travel speeds appropriate to the type of technology (e.g. commuter rail, rapid transit, surface transit) involved, with surface bus speeds reflecting average traffic speeds on the various road links. An "unconstrained" traffic assignment was then carried out and the road system was "sized" by estimating and then costing the number of additional lanes of freeways and arterial roads which would be required to serve the estimated automobile travel demand. Estimated transit volumes were used to "size" the transit

links in terms of required technology, frequency of service and number of vehicles required.

This approach means that equal levels of road and transit service would be provided under each concept. Accordingly, all three concepts are given the same rating, **medium,** under this measure. The differences among them are defined by the differences in road and transit capital costs required to achieve the equal level of service postulated for each concept, and this is picked up under another measure in the comparison (i.e. low capital costs).

Reduced Requirements for School Busing

A concept receives a **high** rating under this measure if the amount of school busing required is reduced. Estimated annual operating costs for school busing are shown in Exhibit 2. Concept 1, Spread, is given a **low** rating because of the extensive amount of school busing required throughout the low density suburban areas, as is now the case in existing residential areas in the suburban regions. Concept 2, Central, is given a **high** rating because the high population density in central areas means that more students would be able to walk to school or take regular transit, thereby allowing a substantial reduction in the effort and cost required for school busing. Concept 3, Nodal, is given a **medium-high** rating because many students would be able to walk or take transit to school within and between the relatively high density nodes postulated in this concept. Estimated annual school bus operating costs in 2021 under each concept are shown in Exhibit 2.

Better Opportunity to Provide Transit for Handicapped Persons

A concept is given a **high** rating under this measure if the combination of urban densities and transportation networks is such that transit services for handicapped persons can be provided relatively cost-effectively as new transit facilities are introduced. Estimated annual operating costs for such services are shown in Exhibit 2. Concept 1, Spread, is given a **medium** rating because it would provide a more extensive road network for paratransit services serving handicapped persons but less opportunity to make new transit facilities handicapped-accessible. Concept 2, Central, is given a **high** rating because it would generated shorter trips (more efficiently served by paratransit) and would provide more opportunity to make new transit facilities handicapped-accessible. Concept 3, Nodal, is given a **medium-high** rating because it would generate intermediate trip length trips and would provide substantial opportunities to make new transit facilities handicapped-accessible. Estimated 2021 annual operating costs for such services under each concept are shown in Exhibit 2.

Low Transportation Capital Costs

A concept has a **high** rating under this measure if the total estimated capital costs required to construct its conceptual transportation network between 1990 and 2021 are relatively low compared to the other concepts. The estimated capital costs, cumulative between now and 2021 and expressed in 1990 dollars, are listed in Exhibit 2 for each concept, showing the costs for roads and transit respectively and the total transportation costs.

As shown, Concept 1, has an estimated transportation capital cost of $27.1 billion, while Concept 2 has an estimated cost of $27.6 billion and Concept 3, $28.6 billion. As also shown, while there are significant differences in the costs for transit and for roads among the three concepts, these tend to balance out so that the total capital costs are essentially the same within the conceptual estimating accuracy of this study. Accordingly, all three concepts are given a **medium** rating under this measure.

Low Transportation Operating Costs for Roads and Transit Operators

As part of the transportation analysis, described more fully in Background Report No. 3, estimates were made of the annual operating cost experienced in 2021 by Public Works departments operating the road system (which vary with the number of lane-km in the network), by the transit operators (which vary with the number of revenue-hours and revenue-km of transit service provided with transit fare revenues netted out) and by travellers using the system (e.g. automobile operating and ownership costs during the a.m. peak period with fuel taxes netted out). These estimates are shown for each concept, in terms of approximate annual operating costs, for each of the three concepts. As shown, Concept 1, Spread, has a 2021 annual transportation operating cost in terms of the above three operating cost components of $11.5 billion, Concept 2, Central $9.6 billion and Concept 3, Nodal $10.7 billion. The pattern is similar to that for road capital costs: owing to the high cost impact of its more extensive road system, Concept 1 has the highest operating costs, while Concept 1 has the lowest and Concept 3 has an intermediate level. Accordingly, Concept 1, Spread, is given a **low** rating under this measure, Concept 2, Central, is given a **high** rating, and Concept 3, Nodal, is given a **medium** rating.

CRITERION 4: HARD SERVICES

Factor 4.1: Trunk Water and Sanitary Sewerage Systems

Low Capital Costs to Expand Trunk Water and Sewerage Systems

A concept is given a **high** rating under this measure if it has a relatively low capital cost for the required trunk water and sewer network. As shown in Exhibit 2, the cost estimates prepared as part of this study (see Background Report No. 4) indicate that all three concepts would have an equal capital cost for this part of the required infrastructure, about $3.7 billion to be invested between now and 2021. Accordingly, each of the three concepts is given a **medium** rating for this measure. It should be noted, however, that these cost do not include providing significant levels of Lake Ontario based water and sewer services to communities north of the Oak Ridge Moraine watershed; capital costs would be higher if more extensive services of this type were provided under any of the urban structure concepts.

Factor 4.2: Solid Waste Management

Low Costs to Provide and Operate Solid Waste Disposal Systems

A concept is given a **high** rating under this measure if the costs for solid waste management are relatively low. As described more fully in Background Report No. 4, the solid waste management costs are primarily operating costs and are estimated to be essentially the same for all three urban structure concepts. The three concepts are all given the same, **medium**, rating as a result.

Factor 4.3: Land Development and Redevelopment

Low Capital Costs for Land Development and Redevelopment, Site Preparation and Local Services

A concept is given a **high** rating under this measure if the capital costs for land development (new land in suburban areas) and redevelopment (on previously urbanized land in central areas) are relatively low. As described more fully in Background Report No. 4, based on current experience, the land development costs on new land are estimated at $70,000 per acre for residential development and $50,000 per acre for industrial development, while redevelopment costs are estimated at $300,000 per acre. These average costs include grading of the development area, installation of local water and sewer services, storm water management, and installation of local electric power service, street lighting, streets and sidewalks.

Concept 1, Spread, is given a **low** rating because it has the highest estimated capital cost for land development/redevelopment at $15.8 billion. Concept 2, Central, is given a **high** rating because its estimated land development/redevelopment cost is lowest of the three concepts, at $9 billion. Concept 3, Nodal, is given a **medium-high**

rating because it has an intermediate estimated capital cost for land development/redevelopment of $11 billion, which is closer to the low value for Concept 2 than it is to the higher value for Concept 1.

CRITERION 5: GREENING/ ENVIRONMENT

Factor 5.1: Greening

High Compatibility With Regional Greenlands Concept

A concept is given a **high** rating for this measure if its urbanized area overlaps with (or consumes) a relatively small area of existing passive green areas, specifically the Lake Ontario Waterfront and Oak Ridges Moraine. Concept 1, Spread, is given a **low** rating because an additional 33 sq. miles (84 km^2) of the Oak Ridges Moraine area and 12 miles (19 km) of the Lake Ontario waterfront would be within the urban envelope. Concept 2, Central, is given a **high** rating because an additional 7 sq. miles (18 km^2) of the Oak Ridges Moraine area and 6 miles (10 km) of the Lake Ontario Waterfront would be within the urban envelope. Concept 3, Nodal, is given a **medium** rating because an additional 18 sq. miles (46 km^2) of the Oak Ridges Moraine area and 8 miles (13 km) of the Lake Ontario waterfront would be within the urban envelope.

High Available Amount of Passive Open Space

A concept is given a **high** rating under this measure if a relatively large amount of passive open space (e.g. river and stream valleys, parks, waterfront parks and conservation areas) would be located within the urbanized area. Concept 1, Spread, is given a **high** rating because about 4 acres (1.6 ha) per 1,000 people would be available as passive open space within its extensive urban area. In order to meet the current rate of 4.4 acres (1.8 ha) per 1,000 people an additional 2,200 acres (890 ha) would have to be acquired at an approximate cost of $1.1 billion. Concept 2, Central, is given a **low** rating because only about 3.1 acres (1.3 ha) per 1,000 people would be available within its considerably smaller urbanized area. To meet the current rate of 4.4 acres (1.8 ha) per 1,000 people would require some 8,000 acres (3,240 ha) of new passive green space to be acquired at an approximate cost of $6 billion. Concept 3, Nodal, is given a **medium-low** rating because about 3.2 acres (1.3 ha) per 1,000 people would be available within its relatively small urbanized area, and an investment of approximately $4.7 billion would be needed to acquire the 7,500 acres (3,040 ha) required to meet the current rate of 4.4 acres (1.8 ha) per 1,000 people.

While the above capital cost estimates are included in order to illustrate this difference among the three concepts, it would clearly be impractical to provide the large acreages indicated for Concepts 2 and 3 within the smaller urbanized areas of these concepts. For example, the 8,000 acres of new passive open space which would be required within the urbanized area if Concept 2 would be about 20 times the area of High Park or the area of Pearson International Airport. In practice, an equal amount of new passive green space would probably be provided under all three concepts within the larger urbanized area of Concept 1; under this assumption all three concepts would have the same capital cost for acquiring 2,200 acres of passive open space ($1.1 billion), but residents living in the central areas under Concepts 2 and 3 would have to travel farther, on average, than would suburban residents of Concept 1 in order to experience that portion of the passive open space which would be located in the suburban parts of the urbanized area.

The ratings in this report reflect the first assumption: that is, the hypothetical cost of acquiring enough new passive open space to provide the same standard under all three concepts. The second assumption would produce lower capital cost estimates for Concepts 2 and 3 under this measure (as shown by the cost ranges in Exhibits 4 and 7), but would also reduce the average accessibility to passive open space under these concepts, such that the ratings would be similar under both assumptions.

High Ease of Disposal of Contaminated Soils

A concept is given a **high** rating under this measure if it has a relatively low amount of contaminated soils produced from the redevelopment of previously urbanized (e.g. industrial/transportation) land which is likely to contain some contaminated soils. Concept 1, Spread, is given a **medium-high** rating since only about 2,750 acres (1,110 ha) of urban redevelopment is involved. Concept 2, Central, is given a **low** rating since it has the highest redevelopment acreage of about 11,000 acres (4,450 ha). Concept 3, Compact, is given a **medium** rating since it would involve about 4,750 acres (1,920 ha) of urban redevelopment.

High Potential for Cleanup of Contaminated Soils

A concept is given a **high** rating under this measure if it provides a relatively high opportunity for existing contaminated soils in urbanized areas to be cleaned up as a part of redevelopment activities. The ratings under this measure tend to be inverse to those for the previous measure, since the greater the amount of redevelopment involved the greater would be the opportunity to clean up existing contaminated sites. Accordingly, as described in Exhibit 2, Concept 1, Spread is given a **medium-low** rating, Concept 2, Central

a **medium-high** rating and Concept 3, Nodal a **medium** rating under this measure.

Factor 5.2: Sustainable Development

High Potential for Improving Quality of Storm Water Drainage

As described in Background Report No. 5, storm water runoff from urbanized (and agricultural) areas carries with it significant concentrations of toxic materials and/or nutrients which cause pollution of streams, rivers and lakes/beaches in and around the GTA. The water quality of this runoff can be substantially improved by a comprehensive range of measures such as building ponds to retain it (thereby allowing sediments to settle out) and by treating the most polluted portion of the retained runoff in water pollution treatment plants during times when the sanitary load on such plants is low. Other examples include continuing the on-going program of separating sanitary and storm sewers, in order to reduce the likelihood that sanitary sewage will not be properly treated in times of high storm runoff. These types of measures are extremely important steps towards maintaining and improving the environmental quality of stream/river valleys and lakefront beaches in and around the GTA.

Concept 1, Spread, is given a **medium-low** rating under this measure because it presents less potential for retrofitting the existing urban area, to improve storm water drainage quality, owing to the smaller amount of urban redevelopment which would occur. Concept 3, Central, is given a **medium-high** rating because it presents the highest potential for retrofitting the existing urbanized area, as part of the redevelopment process in central areas. Concept 3, Nodal, is given a **medium** rating because it presents less potential for retrofitting the existing urbanized area than Concept 2 but has more potential than Concept 1. As described in Background Report No. 5, the estimated cost for improving the quality of storm water drainage throughout the GTA to a minimum level of acceptability would be in the order to $2 billion for each of the three concepts; it is extremely difficult to provide more precise estimates of this cost, however, and the above estimate must be treated as order-of-magnitude only, which is the reason why it is considered impractical to differentiate among the three concepts in terms of cost for this measure

Low Atmospheric Quality Degradation from Transportation Emissions

A concept has a **high** rating under this measure if it produces a relatively low level of emissions from transportation activities. As described in Background Report No. 3, the EMME/2 model produces estimates of automotive emissions in terms of carbon monoxide, carbon dioxide, hydrocarbons and nitrous oxides. Approximate estimates of emissions from public transit vehicles were added to this, although automobile emissions make up over 90% of the total. Total a.m. peak period emissions for a weekday in 1986 were estimated at 1.9 million kg of the above four types of gasses. As shown in Exhibit 2, this is estimated to increase to about 3.3 million kg for Concept 1, 2.6 million kg for Concept 2 and 3.0 million kg for Concept 3 (assuming 1986 vehicle emission rates). Accordingly, Concept 1, Spread, is given a **low** rating since it has the highest emission level, Concept 2, intensified, is given a **high** rating because it has the lowest emission level, and Concept 3, Nodal, is given a **medium** rating because it has an intermediate emission level about half way between that of the other two concepts.

Low Level of Transportation Energy Consumption

A concept is given a **high** rating under this measure if the energy consumption for transportation purposes is relatively low. Again, the EMME/2 model provides estimates of energy consumption for a typical a.m. peak hour and more approximate estimates of energy consumption for public transit and trucks were added to this. As described in Background Report No. 3, automobile energy consumption is over 90% of the total.

The estimated energy consumption was about 26.4 million MJ in 1986. This was estimated to increase to about 46.1 million MJ by 2021 for Concept 1, to 37.2 million MJ for Concept 2 in 2021, and have an intermediate value of 42.1 million MJ for Concept 3 in 2021. Accordingly, Concept 1, Spread is given a **low** rating under this measure because it has the greatest energy consumption for transportation, Concept 2, Central, is given a **high** rating because it has the lowest transportation energy consumption, and Concept 3, Nodal, is given a **medium** rating because it has an intermediate level of transportation energy consumption.

CRITERION 6: HUMAN SERVICES

Factor 6.1: Level of Service, Accessibility, Efficiency and Capital Costs of Human Services

It is particularly difficult in the case of human services to provide quantifiable comparisons of the concepts since these services are relatively less capital and more operating intensive than most other components of the study. To reflect the largely qualitative character of this comparison, we have therefore refrained from applying the extreme ratings of **high** and **low**; rather, we have indicated relative

strengths and weaknesses in terms of **medium-high, medium** and **medium-low.**

Effectiveness/Efficiency of Health Services

A Concept has a **medium-high** rating under this measure if its distribution of people/jobs, transportation system, etc., are conducive to the effective and efficient provision of health services. Concept 1, Spread, is given a **medium** rating under this measure since it would have the least efficient utilization of existing hospitals, the most duplication of services and facilities, the least efficient delivery of community-based non-institutional services, and greatest travel distances to obtain specialized services. Concept 2, Central, is given a **medium-high** rating because it would provide the highest utilization of existing hospitals, the highest level of service to the aging population and referral to specialized services, the greatest opportunity for rationalization of services and facilities, the most efficient delivery of community based primary and non-institutional services, and the shortest travel distances to obtain specialized services. Concept 3, Nodal, is given a **medium** rating because it has a large potential for rationalization and integration of health services within the nodal communities, would allow efficient delivery of community-based non-institutional services, and would have strong potential for deconcentration of a wider range of specialized services to nodes. As shown in Exhibit 2, the capital costs for new hospitals are quite similar for the three concepts, in the range $4.45-5.56 billion.

Effectiveness/Efficiency of Education Services

A concept has a **medium-high** rating under this measure if it lends itself to high effectiveness and relatively low cost of education services, including those provided by primary and secondary schools, community colleges and universities. Concept 1 is given a **medium-low** rating under this measure because it involves greater travel distances, less efficient utilization of primary facilities, greater potential for inefficiencies from duplication, less efficient specialization, and the highest demand for new construction, leading to the highest capital cost. Concept 2, Central, is given a **medium-high** rating because it has the most efficient travel patterns, most opportunity for rationalization and efficient specialization, best utilization of existing primary classroom capacity and therefore least capital cost, and the highest utilization of existing (expanded) colleges and universities. Concept 3, Nodal, is given a **medium** rating because it has intermediate travel distances and a good potential for efficient use of integrated primary and secondary facilities. As shown in Exhibit 2, the estimated capital costs of educational facilities lie in the range of $4.20-6.40 billion for the three concepts, with Concept 2 having the lowest cost and Concept 1 the highest.

Effectiveness/Efficiency Cultural and Recreational Services

A concept is given a **medium-high** rating under this measure if it is such that cultural and recreational services can be provided effectively and at relatively low cost. Concept 1, Spread, is given a **medium-high** rating because it has the lowest land costs ($2.32 billion) for intensive use parks. It has estimated capital costs for cultural/recreational facilities (less parks land costs) of $10.9 billion. On the other hand, it has the least potential for economies of scale and efficiencies from shared, integrated services and facilities and users are required to travel farther, on average to such facilities. Concept 2, Central, is given a **medium** rating. While it would require higher land costs ($4.22 billion) for intensive use parks, it provides maximum use of existing facilities, high utilization of facilities and potential for efficient integration, and highest accessibility levels in terms of short trips, well served by public transit. Concept 3, Nodal, has a **medium-high** rating because it allows for reasonably high space standards for intensive use parks, has good potential utilization levels and opportunity for rationalization of services/facilities, would offer moderate land costs for parks ($2.82 billion) and provide good regional accessibility. With the data and time available for this study, it was not possible to distinguish differences among the concepts in other cultural/recreational capital costs, which were estimated at $10.9 billion for each concept.

Effectiveness/Efficiency of Social Services

A concept has a **medium-high** rating under this measure if the distribution, density and mix of population and employment activities, and the related transportation system, are such that social services (e.g. family and children's services, support programs, enrichment programs, etc.) can be provided effectively and at relatively low cost. Concept 1 is given a **medium-low** rating because it offers relatively less accessibility to those who do not have an automobile available to them, least efficient community-based service delivery, lowest availability of specialized services in low density areas, and lowest overall level of service. Concept 2, Central, is given a **medium** rating because it allows effective use of the existing service agency network as a delivery base, highest accessibility, highest potential for efficient specialization, but less potential for integration and collaboration than might be likely under Concept 3. Concept 3 is given a **medium-high** rating because it has strong potential to build effective community-based support, provides reasonable accessibility, has the highest potential for rationalization and collaboration to achieve efficiencies and higher overall levels of service. Capital costs for social and other health services could not be differentiated among the concepts, based on the data and time available, and were estimated at $2.68 billion for each concept.

Effectiveness/Efficiency of Protection Services

A concept has a **medium-high** rating under this measure if its distribution of people/jobs and available transportation network/services lends itself to fast and reliable response times by police, ambulance and fire services. Concept 1 is given a **medium-low** rating because it has the longest average travel distances and the least efficient distribution of facilities (owing to its lower densities). Concept 2, Central, is given a **medium** rating because it has the lowest average travel distances, although speeds would be lower because of more signalized intersections per km. Concept 3, Nodal, is given a **medium-high** rating because it has potential for efficient circulation patterns and response times owing to relatively short distances in the nodal concentrations. Again the available data and time precluded developing capital cost estimates which differentiate among the concepts; each concept has an estimated capital cost of $2.83 billion for this subcomponent.

It might be argued that protection and public safety would be lower with the higher population densities postulated under Concept 2 and it would therefore be more costly to provide protection services under that concept than under Concept 1. Indeed, the operating cost per capita of policing appears to increase in the GTA with density increase. We have not attempted to rate the concepts in this regard, however, because we received a variety of opinions from those expert in the field regarding the impact of density on per capita crime rates. As noted in Background Report No. 6, there is a positive correlation between poverty and crime but the situation is more confused in terms of a correlation between urban density and crime: in situations of high densities with reasonable income levels, per capita crime rates appear to be similar to those experienced at lower densities with the same income levels; indeed, evidence can be cited that an urban street with steady pedestrian traffic is a safer place than a suburban street with virtually no pedestrian traffic and light vehicular traffic. Because of these substantial uncertainties, we did not include possible variations in per capita crime rates with urban densities as part of this comparison measure.

CRITERION 7: EXTERNAL IMPACTS

Factor 7.1: Nature/Extent of Impacts on the Adjacent Hinterland

Low Pressure for Overspill Development

A concept has a **high** rating under this measure if it is likely to create low pressure for GTA residents to move to homes in the countryside or small communities adjacent to the GTA. Such overspill development is caused by decisions to accept longer commuting times/distances and costs in order to achieve lower housing costs and/or lower residential densities; other possible reasons include a desire for a more "countrified" atmosphere or a decision to retire to a country home with lower living costs and less pressure. There would also likely be a greater propensity for overspill development to the extent that urbanization within the GTA spreads out closer to the GTA boundary. Concept 1, Spread, is given a **low** rating because the spread, low density suburban development moves urbanization closer to the GTA rural boundary and increases pressure for overspill development in adjacent areas. Concept 2, Central, is given a **medium** rating because substantially more farm land is preserved in rural parts of the GTA and urbanization remains further from the GTA boundary. There is a possibility, however, that the higher population density in Concept 2 would create more pressure for some people to move to the country; it is felt likely, however, that this would manifest itself more in a greater propensity to purchase a seasonal home (e.g. in cottage country) rather than moving permanently to a country residence, but there is obviously uncertainty in this regard. This rating also includes the important proviso that the supply and demand of residential land are kept in balance, so that housing prices do not increase unduly; if housing prices were to increase for this (or other) reasons, there could be greater pressure under Concept 2 for overspill development as people trade off longer commuting times in order to achieve more affordable housing. Concept 3, Nodal, is also given a **medium** rating because, while there is more suburban growth than in Concept 2, it is more compact and there would be less pressure for overspill development resulting from urbanization close to the GTA boundary. This rating is subject to the same condition as noted above for Concept 2 regarding housing prices.

It should also be noted that GTA residents moving out from the GTA may decide to locate in existing urban communities such as

Barrie, Cambridge, Hamilton, Peterborough, Port Hope, etc. Relocations of this nature would not have the negative implications of rural overspill development (e.g. ex-urban road traffic for commuter trips, possible water quality impacts of sceptic tank development) unless such people were to retain their jobs in the GTA and continue to commute by automobile. Because of the uncertainties referred to above regarding the manner in which propensities to move from the GTA might vary among the concepts due to economic pressures, and because the impacts of relocations to existing communities well clear of the GTA could be positive or negative depending on work trip patterns, etc., as noted above, it was decided that an attempt to rate the three concepts in this regard would not be productive.

Low Growth of GTA Oriented Road Traffic

A concept is rated **high** under this measure if it tends to create low pressure for growth in road traffic between the GTA and its hinterland. Daily commuting trips by auto are seen as the most serious concern in this regard, but recreational road traffic to rural and cottage areas is another consideration under this measure. Concept 1, Spread, is given a **low** rating because its high dependence on private automobile transportation, coupled with overspill development, would be expected to create considerable growth of road commuting traffic across the GTA boundary and in the ex-urban road system. Concept 2, Central, is given a **medium-low** rating because greater use of public transit, lower auto use/ownership and less overspill development would tend to create less pressure for ex-urban auto commuting traffic. However, there could be greater pressure for recreational traffic to rural/vacation areas under this concept because of its higher urban population density, and the automobile would likely persist as the major mode for such travel. Concept 3, Nodal, is given a **medium-high** rating since, while it has greater suburban residential development than Concept 2, it would have less reliance on the automobile and possibly less pressure for rurally-oriented recreational traffic. Nodal development under this concept would also favour better rail service to suburban and ex-urban centres, which would help to relieve auto traffic growth pressure on roads leading to and from the GTA.

CRITERION 8: OVERALL INFRASTRUCTURE COSTS

Factor 8.1: Capital Costs

Low Overall Transportation, Hard Services, Greening/ Environment and Human Services Capital Costs

A concept has a **high** rating under this measure if its total capital cost for transportation, hard services, greening/environment and human services, cumulative for the period 1990-2021, is relatively low compared to that of the other concepts. The capital cost estimates on which this comparison is based were summarized in earlier parts of Exhibits 2 and are discussed in more detail in the relevant companion background reports. Subsection 3.3, below, also presents a discussion of these estimates. As summarized for factor 8.1 in Exhibit 2, Concept 1, Spread, has an estimated capital cost of $79.3 billion, Concept 2, Central, has an estimated capital cost of $78.7 billion and Concept 3, Nodal, has an estimated capital cost of $78.8 billion. While these are very large numbers, the differences among them are insignificant. Accordingly, all three concepts are given a **medium** rating under this measure. The capital costs for Concepts 2 and 3 would be less than the above ($73.8 billion and $75.2 billion, respectively) if different passive open space standards were assumed for those concepts. The overall capital cost ratings would remain the same, however, since the variation in total capital cost among the three concepts would still be less than 10% which is within the range of uncertainty for a conceptual study of this type.

Low Operating Costs

Turning first to transportation, a concept has a **high** rating under this measure if its transportation operating costs are relatively low compared to the other concepts. As shown in Background Report No. 3 and summarized in Exhibit 2, five components make up the total estimated transportation operating costs: operating costs of road departments (estimated as a function of lane-km of roads in the network), operating costs of transit systems and GO Transit (estimated as a function of revenue-hours and revenue-km of service provided with fare revenues netted out), operating costs of travellers (estimated as the automobile operating and ownership costs with relevant taxes netted out), school bus operating costs and handicapped transit operating costs. All transportation operating costs are estimated on an annual basis as of 2021 in 1990 dollars. School bus and handicapped transit costs are estimated by reference to recent experience, taking into account the characteristics of the three concepts, as described in Background Paper No. 3.

As shown in Exhibit 2, factor 8.2, Concept 1, Spread, has the highest transportation operating costs ($12.0 billion), Concept 2, Central, has the lowest ($9.9 billion) and Concept 3, Nodal, has an intermediate level of transportation operating costs ($11.1 billion). The cost breakdown in Exhibit 2 also shows that the roads department operating costs and the travellers' costs follow the same trend as the total transportation operating costs, while the transit operating costs are highest for Concept 2 and lowest for Concept 1. Because of the preponderance of automobile travel under all three concepts, however, the influence of road department costs and travellers' costs predominates. Accordingly, Concept 1, Spread, is given a **low** rating, Concept 2, Central, is given a **high** rating and Concept 3, Nodal, is given an **medium** rating under this measure. The greater "spread" in the ratings for operating costs (relative to that for capital costs) reflects the fact that the differences in transportation operating costs among the three concepts are more pronounced than the differences in overall capital costs.

The other component under this comparison measure is solid waste disposal operating costs. As pointed out in Background Report No. 4, all three concepts are estimated to have essentially the same solid waste disposal operating costs, so this does not affect the above rating.

Human Services Operating Cost Implications

A concept is given a **high** rating under this measure if its operating efficiency is felt to be high and therefore its operating costs to be relatively low. As indicated in Background Report No. 6, it was beyond the scope of this study to provide quantitative estimates of human services operating costs. Nevertheless, it is possible to draw qualitative inferences regarding the likely variation of operating costs among the three concepts, based on considerations of delivery efficiency, transportation distances and related factors as discussed earlier in this report and in Background Report No. 6. Concept 1, Spread, is given a **low** rating, because its relatively low densities and longer travelling distances (both for servers and clients) would provide less opportunity to provide combined, integrated services at hub locations and would lead to higher operating and access costs. Concept 2, Central, is given a **high** rating, because the higher densities would provide the greatest opportunity for integration of services and facilities, leading to lower operating costs, and the shorter travel distances would contribute further to reduced operating costs. Concept 3, Nodal, is given a **medium-high** rating because the nodal communities would allow easy access and integrated, efficient delivery of services, although travel distances would be longer, on average, than those in Concept 2. It should also be noted that

operating costs in the human services are generally substantially higher than capital costs; more detailed study of these would probably reveal quantitative differences among the concepts, if a sufficiently reliable methodology were developed. However, this would require a level of detail well beyond the scope of this study.

3.3 COMPARISON SUMMARY TABLE

Exhibit 3 provides a graphical summary of the comparisons as developed in the previous section and listed in Exhibit 2. As shown in Exhibit 3, a circle is used to depict graphically the rating of each concept in terms of each measure: the circle is completely black if the concept receives a **high** rating, is three-quarters black if it receives a **medium-high** rating, is half black if it receives a **medium** rating, is one-quarter black if it receives a **medium-low** rating, and is completely white (open) if it receives a **low** rating. Visually, therefore, the greater the amount of black showing in the circles for a given concept, the higher are its ratings.
The purpose of providing this summary array is to assist readers in seeing the entire list of comparison measures, and their application to the three concepts, on a single page in order to help the process of interpreting the overall comparison and its various components.

In accordance with the Terms of Reference, no attempt is made in this study to derive a cumulative rating or "bottom line" comparison of the three concepts. There are two important reasons for this:

1. There is a substantial amount of overlap in a number of the comparison measures used; any attempt to derive a cumulative total would have to account for this and correct for the effects of "double counting";

2. A simple addition of all of the ratings for a particular concept (e.g. on a numerical basis) would make the implicit assumption that each of the measures is equally important in its contribution to an overall "score" for the concept. It is very unlikely that a given group of people assessing the concepts would assign an equal weight to each measure. Equally, it is rather unlikely that any two groups would agree on the relative weighting to be assigned to each measure, if an attempt were made to take this into account.

The information and comparisons provided here are meant to stimulate widespread discussion among political leaders, professional staff, interest groups and the public at large which will be necessary before general conclusions can be drawn regarding the relative importance of the various criteria and measures and, in this context, a

EXHIBIT 3
GTA URBAN STRUCTURE CONCEPTS
COMPARISON MEASURES TABLE

CRITERIA		MEASURES	1. SPREAD	2. CENTRAL	3. NODAL
1. Urban Structure	1.1 Amenities and diversity	Low impact on existing community character	◐	◐	◕
		High range of community sizes	○	◐	●
		High range of community diversity	◔	◐	●
	1.2 Integration and efficiency	High utilization of existing infrastructure	◔	◕	◐
		High regional/local balance of people and jobs	○	●	◕
2. Economic Impetus	2.1 Economic growth opportunities	Low risk of land price increases due to government regulation	◕	◔	◐
		Low land development costs which contribute to economic efficiency	○	●	◐
	2.2 Impact on Agriculture	Low encroachment on agricultural land	○	◕	◐
	2.3 Impact on Natural Resources	Low impact on forest resources	○	◕	◐
		Low impact on mineral resources	◔	◕	◐
3. Transportation	3.1 Choice of modes and service levels	High transit accessibility and service level	○	●	◐
		High road accessibility and service level	●	○	◐
		High effectiveness of intercity connections	◕	◐	◐
		High population accessibility to rural areas	◕	◔	◐
	3.2 Transportation efficiency/costs	Low average trip times, distances and costs	○	●	◐
		High proportion of each Region's work trips remain in the Region	○	●	◐
		High transit efficiency and cost recovery	○	●	◐
		Reduced road traffic congestion growth	◐	◐	◐
		Reduced requirements for school busing	○	●	◕
		Better opp'y to provide handicapped transit	◐	●	◕
		Low transportation capital costs	◐	◐	◐
		Low transportation operating costs	○	●	◐
4. Hard Services	4.1 Trunk water and sanitary sewerage systems	Low water/sewer trunk costs	◐	◐	◐
	4.2 Solid waste management	Low costs for solid waste disposal systems	◐	◐	◐
	4.3 Land development and redevelopment	Low capital costs for land development and redevelopment re local services	○	●	◕
5. Greening/ Environment	5.1 Greening	High compatibility with regional greenlands concept	○	●	◐
		High available amount of passive open space (eg. river valleys and conservation areas)	●	○	◔
		High ease of disposal of contaminated soils	◕	○	◐
		High potential for cleanup of contaminated soil	◔	◕	◐
	5.2 Sustainable development	High potential for improving quality of stormwater drainage	◔	◕	◐
		Reduced atmospheric quality degradation (eg. low transportation emissions)	○	●	◐
		Low level of transportation energy consumption	○	●	◐
6. Human Services	6.1 Level of service, accessibility, efficiency and capital costs of human services	Effectiveness/efficiency of health services	◐	◕	◐
		Effectiveness/efficiency of education services	◔	◕	◐
		Effectiveness/efficiency of cultural and recreational services	◕	◐	◕
		Effectiveness/efficiency of social services	◔	◐	◕
		Effectiveness/efficiency of protection services	◔	◐	◕
7. Ext. Impacts	7.1 Nature/extent of impacts on the adjacent hinterland	Low pressure for overspill development	○	◐	◐
		Low growth of GTA oriented road traffic	○	◔	◕
8. Overall Infra-structure Costs	8.1 Capital costs	Low overall transportation, hard services, greening/environment and human services capital costs	◐	◐	◐
	8.2 Operating Costs	Low operating costs	○	●	◐
		Human services operating cost implications	◔	◕	◕

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LEGEND: Relative Rating Symbols

High Rating	●
Medium-High Rating	◕
Medium Rating	◐
Medium-Low Rating	◔
Low Rating	○

preferred future urban structure concept for the Greater Toronto Area.

There is a great deal of detail presented in Exhibit 3 which, while useful in one respect, makes is somewhat difficult to identify some of the basic similarities, differences, strengths and weaknesses of the three concepts. The interpretive comments provided in Chapter 4, below, are intended to assist in this process.

4. INTERPRETIVE COMMENTS

4.1 COMPARISON HIGHLIGHTS

Capital Costs

The capital cost estimates presented in the previous chapter are summarized in Exhibit 4, which shows the main subheadings within each major component, as well as the component totals. Estimated federal costs (for airports and a rail freight link between the CP and CN main lines in Halton and Peel) are not included in the exhibit, since they would be the same for all three concepts; see Exhibit 13 and also Background Report No. 3).

Capital Cost Differences

The essential (and perhaps unexpected) finding from Exhibit 4 is that, while the estimated capital costs (cumulative requirements over the period 1990-2021) are very large for each of the three concepts, lying in the range $74-$79 billion, the differences among the three concepts are insignificant relative to the absolute size of the cumulative capital costs estimated and the uncertainty range of the estimates. This general conclusion is true even if the lower end of the cost range is taken for Concept 2 ($73.8 billion) and for Concept 3 ($75.2 billion) relative to the single estimate for Concept 1 ($79.3 billion) since the differences are less than 10%.

A similar conclusion can be drawn regarding two of the four major capital cost components: Human Services at $29-30 billion for each of the concepts, and Transportation at $27-29 billion for each of the concepts. The other two components show more significant variation, however:

- **Hard Services**, for which Concept 1, Spread, has the highest cost at $19.5 billion, Concept 2, Central, the lowest at $12.7 billion and Concept 3, Nodal, an intermediate cost at $14.7 billion; and

- **Greening/Environment**, for which Central has the highest cost at $3.1-$8.0 billion, Spread the lowest at $3.1 billion and Nodal an intermediate cost at $3.1-$6.7 billion.

Looking within each component subtotal, the subcomponents showing the most difference among concepts are:

EXHIBIT 4

CAPITAL COST SUMMARY

(CUMULATIVE 1990-2021 TOTALS, IN BILLIONS OF 1990 DOLLARS)

	1. SPREAD	2. CENTRAL	3. NODAL
TRANSPORTATION			
TRANSIT	7.16	14.41	11.58
ROADS	19.93	13.20	17.04
SUB-TOTAL	27.09	27.61	28.62
HARD SERVICES			
WATER/SEWER	3.72	3.68	3.68
LOCAL SERVICES/ROADS	15.76	8.98	11.04
SUB-TOTAL	19.48	12.66	14.72
GREENING/ENVIRONMENT			
PASSIVE OPEN SPACE (LAND)	1.10	1.10-6.00	1.10-4.70
STORMWATER QUALITY	2.00	2.00	2.00
SUB-TOTAL	3.10	3.10-8.00	3.10-6.70
HUMAN SERVICES			
HOSPITALS	4.45	5.56	4.75
SOCIAL & OTHER HEALTH SERVICES	2.68	2.68	2.68
EDUCATIONAL FACILITIES	6.40	4.20	4.79
PROTECTION	2.83	2.83	2.83
CULTURE & RECREATION	10.90	10.90	10.90
PARKS (LAND)	2.32	4.22	2.82
SUB-TOTAL	29.58	30.39	28.77
TOTAL	79.25	73.76-78.66	75.21-78.81

NOTES:

- This table includes expenditures currently commited or announced by governments in the area as well as for longer range needs to 2021.
- The above costs do not include federal costs for new facilities serving the entire GTA, such as for airports, high speed interurban rail service or freight rail links, which would be similar for all concepts.
- If existing capital expenditure levels (averaged for the period 1984-88, see Exhibits 5 and 6 following) are extrapolated for the period 1990-2021 at expanded levels reflecting projected population growth, the total expenditure would be $73.97 billion in 1990 dollars. The estimated total of $79.25 billions for Concept 1, spread, is 7% greater than this extrapolated total, a relatively small increase attributable to assumed increased standards in this study.

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- **roads**, for which Spread has the highest cost at $19.9 billion and Central has the lowest cost of $13.2 billion, with Nodal in between at $17.0 billion;

- **transit**, for which Central has the highest capital cost at $14.4 billion and Spread the lowest capital cost at $7.2 billion, with Nodal again intermediate at $11.6 billion;

- **local services/roads**, for which Spread has the highest capital cost at $15.8 billion, Central has the lowest capital cost at $9.0 billion, and Nodal is intermediate at $11.0 billion; and

- **passive open space**, for which Central has the highest capital cost at $1.1-$6.0 billion, Spread has the lowest capital cost at $1.1 billion, and Nodal is also quite high at $1.1-$4.7 billion. As noted earlier, these capital costs would all be equal (at $1.1 billion) if lower accessibility standards to passive open space were assumed for Concept 2 (and, to a lesser extent, Concept 3) relative to Concept 1.

In all four cases, Concept 3, Nodal, has an intermediate cost between that of the other two concepts. Most of the other subcomponents have costs which are quite similar across the three concepts, except for educational facilities, for which Spread has the highest capital cost at $6.4 billion and Central has the lowest at $4.2 billion, reflecting efficient use of inner city schools which are currently under-utilized. A reverse trend is evident for the land cost of urban parks, however, since Central has the highest estimated cost at $4.22 billion, with Spread lowest at $2.32 billion and Nodal also quite low at $2.82 billion.

Existing and Projected Annual Expenditures

It is useful to consider how the projected future capital cost expenditures shown in Exhibit 4 compare with actual rates of expenditure over the past few years. This comparison is shown in Exhibit 5 which lists actual average annual capital expenditures for the period 1984-88 (as compiled by the office for the Greater Toronto Area) and adjusted to 1990 dollars by the study team, with the average annual expenditures projected for the period 1990-2021 for each of the three concepts as derived from this study. It should be stressed that we did not have the opportunity to check the 1984-88 totals in terms of consistency with the infrastructure elements included in the 1990-2021 projections; there was an evident difference in the allocation of investment among the components so all were combined for this exhibit.

EXHIBIT 5

SUMMARY OF AVERAGE ANNUAL CAPITAL COSTS

(BILLIONS OF 1990 DOLLARS)

	1984-1988 ACTUAL	1990-2021 PROJECTED		
		1. SPREAD	2. CENTRAL	3. NODAL
TRANSPORTATION	1.78	0.87	0.89	0.92
HARD SERVICES		0.63	0.41	0.47
GREENING/ENVIRONMENT		0.10	0.26	0.22
HUMAN SERVICES		0.95	0.98	0.93
TOTAL	1.78	2.55	2.54	2.54

NOTES:

- Annual costs in this table are derived from the 31 year totals in Exhibit 4 by dividing the upper end of the total cost range in Exhibit 4 by 31.
- 1984-88 actual costs are based on OGTA inventory of GTA provincial and municipal capital expenditures for the five year period 1984-88, adjusted to 1990 dollars. All categories are combined because of allocation differences among the categories.
- If the annual 1984-88 expenditures above (and in Exhibit 6) are extrapolated for the period 1990-2021 at expanded levels reflecting projected population growth, the total expenditures would be $73.97 billion in 1990 dollars. This is 7% lower than the total derived for Concept 1, Spread (see Exhibit 4). This relatively small difference is attributable to assumed increases in standards in the derivation of the costs for all three concepts.

The comparison suggests that the recent annual capital cost expenditure level of about $1.78 billion would have to increase about 42% to about $2.5-2.6 billion per year (assuming the upper end of the total capital cost estimate ranges) in order to provide the necessary infrastructure for the three urban structure concepts, as derived in this study. By way of comparison, the OGTA canvassed the relevant provincial ministries and municipalities for their anticipated capital expenditures over the period 1989-1993 and the average annual expenditure which emerged from this exercise was about $2.0 billion per year (for the same infrastructure components as shown in Exhibit 5 for the 1984-88 actual expenditures and also in 1990 dollars), a level about 20% lower than that estimated by this study but higher than the average annual expenditures during 1984-88.

Annual Per Capita Expenditures

It is also useful to compare the future rate of capital investment in infrastructure with that of the recent past on a per capita basis. This is done in Exhibit 6, which shows that recent infrastructure investment levels of about $476 per capita would have to increase to about $510 per capita for each of the three concepts (assuming the high end of the cost range for Concepts 2 and 3). These results suggest that, on a per capita basis, the average annual capital investment in GTA infrastructure would have to increase by about 7% to achieve any of the three concepts at the service levels described in this study.

The general conclusion is that future capital expenditures on a per capita basis would have to be about 7% greater per year than recent annual levels of government expenditures if infrastructure deficiencies are to be overcome and new growth accommodated during the coming 31 years, under all three concepts. There are significant trade-offs between the level of service (quality standards) provided and the required level of infrastructure investments, which are addressed at the end of this section.

Comparison Highlights: Costs to 2021

Capital cost comparisons for the period 1990-2021, as described above, are highlighted in Exhibit 7A, which shows the cumulative investment totals for the four major infrastructure components (transportation, hard services, greening/environment and human services) as well as the totals; also shown are the average annual investment levels and the average annual per capita investment levels for each of the three concepts, in comparison with recent investment levels. As noted, the major capital cost components are human services, which is about 36-39% of the total required investment, and transportation, which is about 34-36%. Hard services is next at 16-

EXHIBIT 6

SUMMARY OF AVERAGE ANNUAL CAPITAL COSTS PER CAPITA

(1990 DOLLARS)

	1984-1988 ACTUAL	1990-2021 PROJECTED		
		1. SPREAD	2. CENTRAL	3. NODAL
TRANSPORTATION	476	174	178	184
HARD SERVICES		126	82	94
GREENING/ENVIRONMENT		20	52	44
HUMAN SERVICES		190	196	186
TOTAL	476	510	508	508

NOTES:

- Annual per capita costs in this table are derived from the annual costs in Exhibit 5 by dividing the actuals by the 1986 population and those of the three concepts by the average population between 1990 and 2021.
- 1984-88 actual totals are based on OGTA inventory of GTA provincial and municipal capital expenditures for the five year period 1984-88, adjusted to 1990 dollars. All categories are combined because of allocation differences among the categories.
- If the annual 1984-88 expenditures above (and in Exhibit 5) are extrapolated for the period 1990-2021 at expanded levels reflecting projected population growth, the total expenditures would be $73.97 billion in 1990 dollars. This is 7% lower than the total derived for Concept 1, Spread (see Exhibit 4). This relatively small difference is attributable to assumed increases in standards in the derivation of the costs for all three concepts.

EXHIBIT 7A

CAPITAL COSTS TO 2021: COMPARISON HIGHLIGHTS

($1990 BILLIONS: 1990-2021 TOTAL)

	1. SPREAD	2. CENTRAL	3. NODAL
TRANSPORTATION COSTS SIMILAR:	27.1	27.6	28.6
HARD SERVICES VARY MOST:	19.5	12.7	14.7
GREENING/ENV. REVERSE TREND:	3.1	3.1-8.0	3.1-6.7
HUMAN SERVICES MAJOR ITEM:	29.6	30.4	28.8
TOTAL CAPITAL COSTS SIMILAR	79.3	73.8-78.7	75.2-78.8
AVERAGE ANNUAL COSTS ABOUT 42% HIGHER THAN 1984-88 LEVEL OF $1.78 BILLION	2.6	2.5	2.5
ANNUAL PER CAPITA CAPITAL COSTS ABOUT 7% HIGHER THAN 1984-88 LEVEL OF $476	510	508	508
MAJOR HIGHLIGHT: CAPITAL COSTS ARE LARGE BUT COST DIFFERENCES AMONG CONCEPTS ARE INSIGNIFICANT AND ESTIMATED FUTURE ANNUAL COSTS PER CAPITA ARE ONLY 7% HIGHER THAN RECENT LEVELS			

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NOTES:

- Upper end of cost range reflects theoretical cost of acquiring passive open space in urbanized area of each concept to maintain existing space standards. Lower end of cost range assumes 2,200 acres of new passive open space are acquired under each concept, within the urbanized area of Concept 1.
- Average annual costs and annual per capita costs are based on the upper end of the total cost ranges.

25% of the total, and greening/environment is lowest at about 4-10% of the total.

In summary, there are three main conclusions from the capital cost comparisons:

- capital cost differences among the three concepts are insignificant compared to the magnitude of the investments, and are well within the uncertainty range of the cost estimates, which is approximately -10% to +30%, in keeping with the conceptual nature of the infrastructure analyses;
- the overall capital investments required are large, in the order of $79 billion over the 31 year period;
- on an annual basis, these investments are approximately 42% larger than recent rates of infrastructure investment in the GTA and on an annual per capita basis they are about 7% greater. These increases, expressed in constant 1990 dollars, reflect the need to make up infrastructure deficiencies which have accumulated during the past decade and the major investments which will be required to maintain service standards at recent levels in the light of substantial continuing growth.

Comparison Highlights: Costs to 2011

Estimated cumulative capital expenditures for the period 1990-2011 are summarized in Exhibit 7B, in the same format as Exhibit 7A. These estimates were derived by prorating the cumulative 1990-2021 estimates on a linear basis in terms of the numbers of elapsed years (that is, multiplying them by the fraction 21/31). In the absence of more detailed planning and staging studies, this broad approach to estimating intermediate investment levels is the most practical and realistic approach, in the view of the consultant team. While the investment amounts are smaller to 2011, the percentage allocations and estimated percent increase in annual average investment levels are the same as in Exhibit 7A. However, our assumption of equal annual investments over the 31 years, reflecting higher per capita "catch-up" expenditures early in the period, leads to a higher average per capita annual expenditure in the 21 year period 1990-2011 than for the 31 year period to 2021, as is evident by comparing Exhibit 7B with Exhibit 7A.

EXHIBIT 7B

CAPITAL COSTS TO 2011: COMPARISON HIGHLIGHTS

($1990 BILLIONS: 1990-2011 TOTAL)

	1. SPREAD	2. CENTRAL	3. NODAL
TRANSPORTATION COSTS SIMILAR:	18.6	18.4	18.9
HARD SERVICES VARY MOST:	13.6	8.4	10.0
GREENING/ENV. REVERSE TREND:	2.2	2.2-5.2	2.2-4.7
HUMAN SERVICES MAJOR ITEM:	20.2	20.5	18.9
TOTAL CAPITAL COSTS SIMILAR:	54.6	49.5-52.5	50.0-52.5
AVERAGE ANNUAL COSTS ABOUT 42% HIGHER THAN 1984-88 LEVEL OF $1.78 BILLION	2.6	2.5	2.5
ANNUAL PER CAPITA CAPITAL COSTS ABOUT 13% HIGHER THAN 1984-88 LEVEL OF $476	553	532	532

MAJOR HIGHLIGHT: CAPITAL COSTS ARE LARGE BUT COST DIFFERENCES AMONG CONCEPTS ARE INSIGNIFICANT AND ESTIMATED FUTURE ANNUAL COSTS PER CAPITA ARE ONLY 13% HIGHER THAN RECENT LEVELS

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- The assumption of equal annual investments over the 31 years, reflecting higher per capita "catch-up" expenditures early in the period, leads to a higher average per capita annual expenditure in the 21 year period 1990-2011 than for the 31 year period to 2021, as is evident by comparing Exhibit 7B with Exhibit 7A.
- See also notes on Exhibit 7A, which apply as well to this exhibit.

Operating Costs

Cost Categories for Which Quantified Estimates Were Produced

Following suggestions by the consultant team, it was agreed with the Committee that quantified estimates of operating costs in the year 2021 for each concept would be provided for the following:

- transportation
  - roads departments;
  - automobile travellers' costs;
  - transit properties;
  - school busing;
  - handicapped transit services.
- hard services
  - solid waste disposal.

It was also agreed that qualitative comments on operating costs and possible capital/operating cost trade-offs would be provided for the various human services (health, education, culture/recreation, social services, protection services) and regarding differences in water pumping costs among the three concepts.

Comparison Highlights: Operating Costs

Highlights of the quantitative operating cost estimates are shown in Exhibit 8. As can be seen, the major subcomponent of transportation operating costs is automobile travellers' operating and ownership costs. In order to avoid double counting, fuel taxes have been subtracted from these costs, just as transit fare revenues have been subtracted from the operating costs of the transit systems. The auto travellers' costs, expressed on an annual basis for the year 2021, are estimated at about $10.2 billion for Concept 1, Spread, $8.0 billion for Concept 2, Central, and $9.2 billion for Concept 3, Nodal. The total transportation operating costs range from $12.0 billion for Spread to $9.9 billion for Central and $11.1 billion for Nodal. It can be seen that auto travellers' costs range from about 88% of the total in the Central concept to about 88% of the total in the Spread concept.

Qualitative Comments on Other Operating Costs

Qualitative comments on the relative efficiencies of service delivery and accessibility for the various human services are implicit in the concept ratings summarized in this report, and are described in more detail in Background Report No. 6. Background Report No. 4 provides a brief commentary on water pumping cost differences.

EXHIBIT 8

OPERATING COSTS: COMPARISON HIGHLIGHTS

(ANNUAL COSTS IN 2021, IN BILLIONS OF 1990 DOLLARS)

	1. SPREAD	2. CENTRAL	3. NODAL
TRANSPORTATION			
ROADS DEPARTMENTS	0.24	0.21	0.23
AUTO TRAVELLER COSTS	10.15	7.98	9.15
TRANSIT PROPERTIES	1.13	1.37	1.32
SCHOOL BUSING	0.27	0.17	0.22
HANDICAPPED TRANSIT	0.17	0.14	0.17
SUB-TOTAL	11.96	9.87	11.09
HARD SERVICES			
SOLID WASTE DISPOSAL	1.00	1.00	1.00
TOTAL OPERATING COSTS QUANTIFIED IN THIS STUDY	12.96	10.87	12.09

NOTE:

- Other operating costs (eg. human services, etc.) not quantified.

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Quantitative estimates of these operating costs were not attempted in this study for the reasons outlined earlier.

Urban Structure

Several aspects of the urban structure comparison are highlighted in this section, including population density levels, land consumption, and the various comparison measures described in Chapter 2.

Population Densities

A summary of population densities in various parts of the GTA and for the total GTA is provided in Exhibit 9. This exhibit presents the 1986 densities and the postulated 2021 densities for each of the three urban structure concepts, for the five regional municipalities making up the GTA, for the five largest area municipalities, and for the GTA as a whole.

Perhaps the most significant highlight from this set of numbers is the observation that Concept 2, Central, would have a population density in 2021 very similar to that of the City of Toronto in 1986 and less than the City's projected 2021 population density under Concept 1, Spread. Under Concept 2, the City's density would increase to about 50 persons per acre, which is similar to that in the central cities of a large number of metropolitan areas in various countries, as discussed in Background Report No. 1. The Cities of North York and Scarborough would have densities under Concept 2 which are only slightly less than the current density of the City of Toronto. The GTA as a whole would have a population density under Concept 2 which is slightly less than the current density of Metropolitan Toronto.

The gross population density of Metro Toronto under Concept 2 would be about 30 persons per acre (12 per ha) in 2021, which is very close to the current population density of the City of Toronto, 29.1 persons per acre (11.8 per ha). The overall density of the GTA under Concept 2 in 2021 would be about 16 persons per acre (6.5 per ha), quite similar to that currently experienced in Metro Toronto (17.5 persons per acre or 7.1 per ha). For comparison, the gross population density in Metro Toronto would be about 22 persons per acre (8.9 per ha) in 2021 under Concept 3 and the density of the entire GTA would be about 15 persons per acre (6.1 per ha) under this concept. Under Concept 1, the gross population density in Metro Toronto would be about 19 persons per acre (7.7 per ha) in 2021 and the density of the entire GTA would be about 13 persons per acre (5.3 per ha). Gross population density, as presented in the above examples, is defined as total population divided by gross residential acres (including streets, parks, schools, etc.) in the jurisdiction.

EXHIBIT 9

POPULATION DENSITY SUMMARY

(POPULATION PER GROSS RESIDENTIAL ACRE)

	1986	2021		
		1. SPREAD	2. CENTRAL	3. NODAL
REGIONAL MUNICIPALITIES				
DURHAM	8.7	9.9	9.0	10.2
HALTON	7.9	8.8	8.2	10.5
METRO	17.5	19.4	30.4	22.4
PEEL	11.5	12.3	11.8	13.9
YORK	8.5	9.2	8.8	10.7
SELECTED AREA MUNICIPALITIES				
TORONTO	29.1	32.2	50.1	37.1
NORTH YORK	15.2	16.9	27.0	19.5
SCARBOROUGH	14.1	16.2	28.7	18.7
ETOBICOKE	13.1	14.1	19.7	16.2
MISSISSAUGA	11.5	12.8	12.0	14.7
GTA TOTAL	12.9	12.6	16.9	14.9

NOTE:

- Incremental development densities on new land in the four suburban regions are assumed to be in the range 6-20 persons/acre in Concepts 1 and 2 and 15-30 persons/acre in Concept 3. Redevelopment densities in Metro are 240-300 persons/acre in all three concepts. Average densities shown in the above table show much smaller differences among the three concepts because they include the influence of existing development densities which are, of course, the same in all three concepts. Average suburban densities are lower in Concept 2 than in Concept 1 for this reason: there is much less population growth in the suburbs under Concept 2 (at higher incremental densities) so the increase in average density is less in Concept 2 in the four suburban regions than it is in Concept 1.

The point being highlighted is that we have current examples of the average population density which would be experienced for Metro Toronto for Concept 2 (e.g. the City of Toronto) and for the GTA under Concept 2 (e.g. Metro Toronto) and these examples suggest that the central densities implied by Concept 2 would likely be acceptable to a substantial number of people, such as those who currently live in the City of Toronto. The population density for the GTA under Concept 1, Spread, would be essentially the same as that in 1986 while the GTA density for Concept 3, Nodal, would be intermediate but closer to that of Concept 3 than that of Concept 2.

New Urbanized Land

As summarized in Exhibit 10, there would be significant differences in the amount of new (rural) land urbanized between 1986 and 2021 under the three concepts. In 1986 the urbanized area of the GTA was about 590 sq.miles (1,520 km^2) or about 21% of the total GTA land area. Under Concept 1, Spread, an additional 350 sq.miles (900 km^2) would be urbanized, while the new urbanized land would be about 140 sq.miles (350 km^2) under Concept 2 and about 230 sq.miles (590 km^2) under Concept 3. This means that the urbanized area would be about 34% of the entire GTA by 2021 under the Spread Concept, about 26% under the Central Concept and about 29% under the Nodal Concept. Some 213 sq.miles (552 km^2) of Class 1, 2 and 3 agricultural land would be consumed by Concept 1, Spread, some 45 sq.miles (117 km^2) by Concept 2, Central and some 112 sq.miles (290 km^2) under Concept 3, Nodal.

Comparison Highlights

Concept comparison highlights under the urban structure criterion are summarized in Exhibit 11. In addition to highlighting the population density and land consumption figures noted above, this exhibit also summarizes the ratings under the five comparison measures relating to the urban structure criterion. In general, the Nodal Concept received higher ratings for these measures, followed closely by the Central Concept.

Economic Impetus

The concept comparison ratings for the five measures under this criterion are highlighted in Exhibit 12, along with relevant quantitative measures.

Factors Affecting Land Prices

Two factors affecting land prices and therefore affecting future economic growth are illustrated in Exhibit 12 and discussed more fully in Background Report No. 7. The premise is that economic growth will tend to be slowed if prices of serviced land for urban development or redevelopment rise substantially, thereby increasing the average prices of housing and employment facilities. It is suggested that there are two basic forces which could lead to increased prices for serviced land, housing, etc:

EXHIBIT 10

GTA URBANIZED LAND AREA SUMMARY

GTA TOTAL AREA: 7,200 KM^2

URBANIZED AREA 1988: 1,520 KM^2

PERCENT URBANIZED 1986: 21%

	1. SPREAD	2. CENTRAL	3. NODAL
ADDITIONAL URBANIZED LAND 1988-2021 (KM^2)	900	350	590
URBANIZED AREA 2021 (KM^2)	2,420	1,870	2,110
PERCENT URBANIZED 2021:	34%	26%	29%

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EXHIBIT 11

URBAN STRUCTURE: COMPARISON HIGHLIGHTS

	1986	2021		
		1. SPREAD	2. CENTRAL	3. NODAL
GROSS POPULATION DENSITIES WITHIN FAMILIAR RANGE (PPA):				
CITY OF TORONTO	29	32	50	37
REST OF METRO	14	16	26	19
METRO TORONTO	18	19	30	22
4 SUBURBAN REGIONS	9	9	9	12
TOTAL GTA	13	13	17	15
WIDE VARIATION IN RURAL LAND CONSUMED FOR URBANIZATION (KM^2)	1,520	+ 900 = 2,420	+ 350 = 1,870	+ 590 = 2,110
URBANIZED PERCENT OF TOTAL GTA LAND ALSO VARIES SIGNIFICANTLY	21%	34%	26%	29%
GROWTH IMPACTS ON EXISTING COMMUNITY CHARACTER DIFFER, BUT SIMILAR OVERALL WITH NODAL HAVING A SLIGHTLY LOWER IMPACT		◐	◐	◕
NODAL GIVES WIDER RANGE OF COMMUNITY SIZES		○	◐	●
NODAL ALSO LIKELY TO PROVIDE BROADER RANGE OF COMMUNITY DIVERSITY IN HOUSING TYPES/OWNERSHIP, DENSITIES AND MIX OF RESIDENTIAL/JOB ACTIVITIES		◐	◐	●
CENTRAL BUILDS MOST EFFICIENTLY ON EXISTING URBAN INFRASTRUCTURE		◔	◕	◐
CENTRAL GIVES GREATEST REGIONAL/ COMMUNITY BALANCE OF PEOPLE AND JOBS, FOLLOWED CLOSELY BY NODAL		○	●	◕

LEGEND: Relative Rating Symbols

High Rating	●
Medium-High Rating	◕
Medium Rating	◐
Medium-Low Rating	◔
Low Rating	○

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EXHIBIT 12

ECONOMIC IMPETUS: COMPARISON HIGHLIGHTS

	2021		
	1. SPREAD	2. CENTRAL	3. NODAL
SPREAD INVOLVES LEAST RISK OF LAND SUPPLY/DEMAND IMBALANCE AND RESULTING HOUSING PRICE INCREASES	◕	◔	◐
CENTRAL HAS LOWEST LAND DEVELOPMENT COSTS PER NEW RESIDENT AND THEREFORE LOWEST LIKELY COST PUSH ON HOUSING PRICES	\$3,000-4,000 ○	\$1,000-1,500 ●	\$2,000-3,000 ◐
CENTRAL HAS LOWEST CONSUMPTION OF AGRICULTURAL LAND (KM^2) FOLLOWED CLOSELY BY NODAL	545 ○	115 ◕	285 ◐
CENTRAL HAS LOWEST CONSUMPTION OF FOREST RESOURCES LANDS (KM^2)	69 ◔	38 ◕	51 ◐
CENTRAL HAS LOWEST CONSUMPTION OF MINERAL RESOURCES LANDS (KM^2)	33 ◔	8 ◕	20 ◐

LEGEND: Relative Rating Symbols

High Rating	●
Medium-High Rating	◕
Medium Rating	◐
Medium-Low Rating	◔
Low Rating	○

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1. Restrictions on the rate at which serviced land is delivered to the market, thereby creating a supply/demand imbalance and leading to price increases;

2. High costs of preparing the land for development/redevelopment and providing local services/roads/utilities, which would drive up the prices of housing and other buildings even if an appropriate supply/demand balance were maintained.

Supply-Demand Imbalance of Serviced Land

As pointed out in Exhibit 12, the three concepts are rated quite differently in terms of these two measures: Concept 1 is given a **medium-high** rating in terms of having a low risk of supply/demand imbalance and resulting housing price increases, because this concept would involve the lowest level of government regulation; conversely, Concept 2, Central is given a **medium-low** rating in terms of this measure because more government regulation would be required to achieve the major redistribution of growth under this concept with a resulting increased risk of a supply/demand imbalance if, for example, new land for redevelopment in central areas are not delivered quickly enough to meet the increased demand. It is, of course, by no means certain that Concept 1 would perform better in terms of land supply/demand balance than would Concept 2; there have been times when the ability of the existing planning, servicing and approval process to deliver serviced suburban land may have lagged behind rapid growth in the GTA and thereby contributed to significant housing price increase on a number of occasions over the past three decades, including the past six years. Nevertheless, it is felt that the risk of a supply/demand imbalance would possibly be higher under Concept 2, Central, since the process of increasing the supply of central area land for redevelopment at the same time as the rate of delivery of new suburban land is decreased would require very careful management by the governments involved. Concept 3, Nodal, would also require an increased level of government regulation to achieve the more compact, nodal development, but the level of regulation and the risk of a land delivery supply/demand imbalance would be less under Concept 3 than under Concept 2, in the view of the consultant team, and this concept is therefore rated **medium**.

Cost Push on Land Prices

The other major factor affecting prices of serviced land is the cost of land development and redevelopment, including local hard services/utilities. A concept has a **high** rating under this measure if it has a low consumption of new land for development, which helps to reduce per capita land development costs and thereby to moderate price increases for land, housing and employment facilities.
Concept 1, Spread has a **low** rating since most of the residential

development and much of the employment development would take place on new land, with relatively high per capita land development costs ($3,000-$4,000 per new resident) because of the low densities involved. Concept 2, Central, is given a **high** rating because it would have relatively low land development costs ($1,000-$1,500 per new resident) due to less consumption of new land at low densities and more redevelopment at higher densities. Concept 3, Nodal, is given a **medium** because it would have intermediate levels of land consumption, densities and land development costs ($2,000-$3,000 per new resident). Land development costs for new land are estimated at $70,000 per acre for residential land and $50,000 per acre for industrial land, while comparable costs for redeveloped land are estimated at $300,000 per acre.

Other Economic Measures

In terms of the other measures under the economic impetus criterion, which relate primarily to the loss of land devoted to agricultural, forest products and mineral resources economic activities, it can be seen that, as would be expected, Concept 2, Central receives the highest rating because of its lower consumption of new land for urbanization, Concept 2, Spread has the lowest rating and Concept 3, Nodal has an intermediate rating in terms of land consumption in these categories.

Transportation

Concept comparison highlights under the transportation criterion are presented in Exhibit 13, which summarizes the concept ratings for each of the 12 measures under this criterion and relevant quantitative estimates.

Comparison Highlights: Transportation

In general, it can be seen that Concept 1, Spread, receives the highest ratings in terms of having an extensive road transportation network, good intercity connections, and effective access to rural areas. Concept 2, Central, receives the highest rating for having the most extensive transit network, the lowest travel effort (in terms of average trip time, trip distance and trip cost, etc.), the lowest level of inter-regional (cross-boundary) travel, the highest level of transit cost-efficiency, the lowest school busing costs, the best opportunities for providing transit for mobility-handicapped persons, the lowest capital costs, and the lowest operating costs. Concept 3, Nodal, generally receives intermediate ratings in terms of most of the transportation measures, often close to the rating of the most favoured concept.

Estimated Road Capacity Increases/Costs to Achieve Equal Levels of Service

As noted in Background Report No. 3, the transportation demand and sizing analysis produced estimates of the number of lane-km of major roads and arterial roads which would be required to achieve similar peak period travel speeds (generally at level of service E as defined by the highway capacity manual) as were experienced in 1986.

EXHIBIT 13

TRANSPORTATION: COMPARISON HIGHLIGHTS

(SIMULATED FOR A.M. PEAK PERIOD: 6:00-9:00 A.M.)

	1986	2021		
		1. SPREAD	2. CENTRAL	3. NODAL
CENTRAL HAS HIGHEST LEVEL OF RAIL TRANSIT SERVICE:		○	●	◑
- IMPROVED COMMUTER RAIL (KM)		410	360	410
- NEW RAPID TRANSIT (KM)		81	178	181
- SERVICE FREQUENCY		Lowest	Highest	High
SPREAD HAS LARGEST ROAD NETWORK:		●	○	◑
- NEW FREEWAYS (LANE-KM)		2,035	784	1,024
- NEW ARTERIALS (LANE-KM)		5,237	3,908	5,472
SPREAD HAS SLIGHTLY BETTER INTERCITY CONNECTIONS FOR TRAVELLERS AND GOODS		◕	◑	◑
SPREAD HAS BETTER ACCESS TO RURAL AREAS		◕	◔	◑
CENTRAL HAS LOWEST TRAVEL EFFORT:		○	●	◑
- AVERAGE TRIP TIME (MINUTES)	27.4	27.5	24.7	26.5
- AVERAGE TRIP DISTANCE (KM)	13.4	15.0	13.2	14.4
- AVERAGE TRIP COST ($)		3.15	2.70	2.99
- PERSON-HOURS OF TRAVEL (MILLIONS)	0.244	0.385	0.368	0.381
- PERSON-KM OF TRAVEL (MILLIONS)	9.11	16.99	14.42	16.11
CENTRAL HAS LOWEST CROSS-BOUNDARY TRIPS:		○	●	◑
- INTRA-REGIONAL	76%	70%	78%	73%
- 4 REGIONS TO METRO	14%	17%	10%	15%
- METRO TO 4 REGIONS	7%	7%	9%	8%
- AMONG 4 REGIONS	3%	5%	3%	4%
CENTRAL HAS HIGHEST TRANSIT COST-EFFICIENCY		○	●	◑
COSTING ASSUMES SUFFICIENT ROAD NETWORK EXPANSION TO ACHIEVE EQUAL LEVELS OF ROAD CONGESTION		◑	◑	◑

LEGEND: Relative Rating Symbols

High Rating	●
Medium-High Rating	◕
Medium Rating	◑
Medium-Low Rating	◔
Low Rating	○

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EXHIBIT 13 (CONT'D)

TRANSPORTATION: COMPARISON HIGHLIGHTS

(SIMULATED FOR A.M. PEAK PERIOD: 6:00-9:00 A.M.)

	1986	2021		
		1. SPREAD	2. CENTRAL	3. NODAL
CENTRAL HAS LOWEST SCHOOL BUSING COSTS:		○	●	◐
- ANNUAL 2021 OPERATING COSTS ($1990 BILLION)	0.15	0.27	0.17	0.22
CENTRAL HAS BEST HANDICAPPED TRANSIT OPPORTUNITIES		◐	●	◕
- ANNUAL 2021 OPERATING COSTS ($1990 BILLION)	0.02	0.17	0.14	0.22
CAPITAL COSTS ARE SIMILAR:		◐	◐	◐
- ROADS ($1990 BILLIONS OVER PERIOD 1990-2021)		19.9	13.2	17.0
- TRANSIT ($1990 BILLIONS OVER PERIOD 1990-2021)		7.2	14.4	11.6
- TOTAL ($1990 BILLIONS OVER PERIOD 1990-2021)		27.1	27.6	28.6
CENTRAL HAS LOWER ANNUAL OPERATING COSTS:		○	●	◐
- ROADS NETWORK AND AUTO COSTS ($1990B IN 2021)	5.7	10.4	8.2	9.4
- TRANSIT SYSTEM ($1990B IN 2021)	0.7	1.1	1.4	1.3
- TOTAL ($1990B IN 2021)	6.4	11.5	9.6	10.7
SIMILAR FEDERAL TRANSPORTATION COSTS*				
- NEW/EXPANDED AIRPORT		(MAJOR INVESTMENT)		
- FREIGHT RAIL LINK, MILTON TO HALWEST		0.7	0.7	0.7

NOTE:

* Not rated: Related Provincial/Municipal costs are similar across all three concepts and are broadly included in cost totals but Federal costs are not included in the totals.

LEGEND: Relative Rating Symbols

High Rating	●
Medium-High Rating	◕
Medium Rating	◐
Medium-Low Rating	◔
Low Rating	○

The assumption made in order to compare the concepts was that all of the required lane-km of new and widened roads would be added as required to achieve the level of services. This is reflected in the transportation capital cost and operating cost estimates and implies that all three concepts would experience 1986 road travel speeds (i.e. an equal level of service in terms of congestion levels).

All three concepts are therefore given a medium rating under this measure, since all would have the same level of road traffic congestion. It should be pointed out, however, that in order to achieve such parity of road traffic service levels, Concept 1, Spread, would require the addition of some 19 lanes of urban arterial roads into the central area of Toronto to carry estimated inbound auto traffic demands in the a.m. peak hour in 2021, while Concept 3, Nodal, would require an additional 13 inbound lanes and Concept 2, Central, would function without any additional lanes of radial roadway in the central areas. These differences, as well as extensive differences in the lane-km of new roads required to serve suburban areas under the three concepts, are reflected in the estimated capital costs for roads under each of the three concepts.

To the extent that it would be impractical to add such a substantial number of new roads in the central areas under Concept 1 and even under Concept 3, there could be a greater tendency for traffic congestion to increase in central areas under these concepts than under Concept 2. This, in turn, could lead to increased economic costs from the resulting traffic congestion which could act to retard economic growth and would probably force other transportation investments or result in caps being placed on further population and employment growth. It was felt that the most direct way of estimating and illustrating these differences among the three concepts would be to identify the differing capital costs to supply the required additional roads to provide an equal level of service under each concept.

The approach taken is logical in economic terms as a means of comparing the three concepts regarding road system requirements. It is by no means certain, however, that the additional lane-km of roads could physically be added in central areas at the level postulated for Concept 1, or possibly at the lower level postulated for Concept 3. Therefore, while this comparison is valid at the conceptual level, its validity at the practical level would require more detailed planning studies which are beyond the scope of the current, conceptual study. The practicality of Concept 1, Spread, is therefore thrown into question under this measure to a substantially greater degree than that of Concept 3, while Concept 2 does not suffer from this

problem. In practice, fewer new lanes of roads in central areas would likely be added under Concepts 1 and possibly 3 than are identified in this study, reflecting the space limitations and disruptions of such extensive road additions. Congestion levels would therefore increase unless other steps, such as growth limitations or provision of more transit, were taken. The economic costs of such steps are reflected for purposes of this comparison in the substantially higher road capital costs estimated for Concept 1 and, to a lesser extent, Concept 3.

Net Present Value of Transportation Capital and Operating Costs

Because of the importance of transportation costs, both capital and operating, in contributing to the total costs of each concept, it is useful to express the stream of expenditures over the 31 year period from 1990 to 2021 on a Net Present Value (NPV) basis for both sets of costs (capital and operating). This was done assuming a discount rate of 7% per annum. On this basis, the net present value in 1990 of the stream of transportation capital expenditures would be $10.2% billion for Concept 1, Spread, $10.4 billion for Concept 2, Central and $10.8 billion for Concept 3, Nodal. The net present value of the transportation operating costs in 1990 would be $103.9 billion for Concept 1, $93.4 billion for Concept 2, and $99.5 billion for Concept 3. Taking the combined net present value of both capital and operating costs in 1990, we have $114.1 billion for Spread, $103.8 billion for Central and $110.3 billion for Nodal. Again, the differences among these values are small relative to the absolute values, in the order of ±5%. The point illustrated is that operating costs are very significant relative to capital costs, and the approximately $2 billion difference in annual operating costs between Concept 1 and Concept 2 should be taken into account when assessing the cost aspects of the various concepts. As noted earlier, however, 80-85% of transportation operating costs are borne by the private sector (automobile drivers) so that the additional $2 billion per year to operate Concept 1 relative to Concept 2 would be less significant in public sector terms than the numbers would suggest. The operating cost differences are worth noting, however, regardless of who pays them.

Transportation Ratings Summary

In overall terms, Concept 2, Central, tended to receive higher ratings under the transportation criterion, followed fairly closely by Concept 3, Nodal, with Concept 1, Spread having the lowest ratings except for the three measures referred to above.

Hard Services

Water and Sanitary Sewerage Systems

The hard services comparisons of the three concepts are highlighted in Exhibit 14. As shown, and as discussed in Chapter 2 earlier, the three concepts are essentially equal in terms of capital costs for trunk water and sanitary sewerage systems and for the costs of solid waste management. As noted, none of the concepts assumes a significant increase in the amount of development north of the Oak Ridges Moraine watershed which would be served by Lake Ontario based water and sewer systems. Increased capital costs would be experienced for any concept in which such development and servicing were to occur.

Land Development/ Redevelopment Local Hard Services

In contrast, significant differences are estimated in the costs for land development/redevelopment, including site preparation, local services/utilities and local roads. Concept 1, Spread, has the highest cost under this measure at $15.8 billion, Concept 2, Central has the lowest cost at $9.0 billion, and Concept 3, Nodal has an intermediate cost at $11.0 billion. This is because, while the cost per acre for redevelopment (as noted earlier a value of $300,000 per acre was used in this study) is substantially higher than the cost per acre for developing new land (values of $70,000 per acre for residential land and $50,000 per acre for industrial land were used) the substantially higher area of new land to be developed under Concept 1 gives it a much higher cost under this measure. It could be argued that, since the land development/redevelopment cost is borne by the developer, this was not a public sector investment and therefore should not be included in the comparison. The study team is of the view, however, that these costs should be included because they are passed directly on to the new resident or employer occupying the premises in terms of purchase or rental prices. There is also an increasing tendency to treat other infrastructure investments in the same manner, through developer levies and special taxes, so that the manner in which local development costs are borne by the developer and thus passed on to the purchaser is becoming more common for other types of urban infrastructures.

Hard Services Ratings Summary

In overall terms, Concept 2, Central, received higher ratings under the hard services criterion (reflecting the above differences in land development/redevelopment costs) with Concept 1, Spread, having the lowest rating and Concept 3, Nodal, having an intermediate rating.

EXHIBIT 14

HARD SERVICES: COMPARISON HIGHLIGHTS

	2021		
	1. SPREAD	2. CENTRAL	3. NODAL
EQUAL COSTS FOR TRUNK WATER AND SANITARY SEWERAGE SYSETMS: ($1990 BILLIONS OVER PERIOD 1990-2021)	◐ 3.7	◐ 3.7	◐ 3.7
EQUAL COSTS FOR SOLID WASTE MANAGEMENT: (2021 ANNUAL OPERATING COSTS* IN BILLIONS OF 1990 DOLLARS)	◐	◐	◐
- CENTRALIZED SYSTEM	0.77	0.77	0.77
- DECENTRALIZED SYSTEM	1.00	1.00	1.00
CENTRAL HAS LOWEST COSTS FOR LAND DEVELOPMENT/REDEVELOPMENT LOCAL HARD SERVICES: ($1990 BILLIONS OVER PERIOD 1990-2021)	○ 15.8	● 9.0	◕ 11.0

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NOTE:

* Includes all costs, but considered as operating costs since contracted out.

LEGEND: Relative Rating Symbols

High Rating	●
Medium-High Rating	◕
Medium Rating	◐
Medium-Low Rating	◔
Low Rating	○

Greening/Environment

Concept comparison highlights for the greening/environment criterion are summarized in Exhibit 15, including the ratings under the seven measures for this criterion and relevant quantitative estimates.

Comparison Highlights: Greening/Environment

It can be seen that Concept 1, Spread, receives the highest ratings under two measures, in that it would have the lowest requirement to acquire a new passive green land within the urban area and it would have the least amount of contaminated soil (from redeveloped areas) to dispose of. Concept 2, Central, is rated highest in terms of its compatibility with the regional green lands concept (e.g. the lowest overlap with passive green areas such as the Lake Ontario shoreline, Oak Ridges Moraine and river/stream valleys), providing the greatest opportunity for clean-up of contaminated soil (because this could be done economically as part of the extensive redevelopment under this concept), having the greatest potential to improve the quality of storm water runoff (because measures to improve runoff quality in central areas can be economically introduced as part of the redevelopment there), producing the least amount of air pollution from transportation (because of the lowest level of automotive use) and having the lowest level of transportation energy consumption (because of shorter and more transit oriented trips). Concept 3, Nodal, has intermediate ratings in all cases, receiving a **medium** rating under seven of the eight measures.

Greening/Environment Ratings Summary

In general, Concept 2, Central, receives higher ratings under the greening/environment criterion, followed by Concept 3, Nodal, with Concept 1, Spread, receiving lower ratings in general, reflecting its greater consumption of resources and more negative environmental impacts.

Human Services

The concept comparisons under the five measures falling within this criterion, and relevant quantitative estimates, are highlighted in Exhibit 16.

Comparison Highlights: Human Services

Concept 1, Spread, receives the highest rating for one of the five measures, cultural/recreation facilities and services, for which it has the same rating as Concept 3, Nodal. Concept 2, Central, receives the highest rating in terms of the effectiveness and efficiency of providing health services and education services. Concept 3, Nodal, receives the highest rating in terms of effectiveness/efficiency of cultural recreation, social services and protection services. These ratings reflect the opinion of the human services group, and the outside advisors convened for a focus group session during the study, that the nodal urban structure lends itself to efficient and effective provision of human services across the board, exceeded only by the Central Concept in terms of health services (better ability to provide

EXHIBIT 15

GREENING/ENVIRONMENT: COMPARISON HIGHLIGHTS

	1986	2021		
		1. SPREAD	2. CENTRAL	3. NODAL
CENTRAL HAS GREATEST COMPATIBILITY BETWEEN REGIONAL GREENLANDS CONCEPT AND NEW URBANIZED AREA		○	●	◑
- OAK RIDGES MORAINE AREA OVERLAP (KM^2)		90	26	51
- LAKE ONTARIO SHORELINE OVERLAP (KM^2)		16	6	10
SPREAD HAS LOWEST NEED TO ACQUIRE NEW PASSIVE GREEN LAND IN URBAN AREA		●	○	◔
- ADDITIONAL AREA TO ACHIEVE 1.8 HA/1000 (KM^2)		8.9	32.4	30.4
- 1990-2021 LAND ACQUISITION COSTS ($1990B)		1.1	6.0	4.7
- LAND COSTS IF ACQUIRED AS UNDER CONCEPT 1 ($1990B)		1.1	1.1	1.1
SPREAD HAS LEAST CONTAMINATED SOIL PRODUCED		◕	○	◑
- REDEVELOPED AREA (KM^2)		11.1	44.5	19.2
CENTRAL OFFERS GREATEST OPPORTUNITY FOR CLEANUP OF CONTAMINATED SOIL		◔	◕	◑
CENTRAL HAS GREATEST POTENTIAL TO IMPROVE QUALITY OF STORMWATER RUNOFF		◔	◕	◑
CENTRAL HAS LOWEST AIR QUALITY DEGRADATION FROM TRANSPORTATION EMISSIONS		○	●	◑
- KG OF C0, $C0_2$, HC'S, NO_x'S, 2021 A.M. PEAK PERIOD (M)	1.9	5.2	2.6	3.0
CENTRAL HAS LOWEST LEVEL OF TRANSPORTATION ENERGY CONSUMPTION		○	●	◑
- MJ CONSUMED, 2021 A.M. PEAK PERIOD (M)	26.4	46.7	37.2	42.1

LEGEND: Relative Rating Symbols

High Rating	●
Medium-High Rating	◕
Medium Rating	◑
Medium-Low Rating	◔
Low Rating	○

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EXHIBIT 16

HUMAN SERVICES: COMPARISON HIGHLIGHTS

	2021		
	1. SPREAD	2. CENTRAL	3. NODAL
CENTRAL PROVIDES HEALTH SERVICES MORE EFFECTIVELY BUT CAPITAL COSTS SIMILAR:	◐	◕	◐
- HOSPITAL CAPITAL COSTS @ 3.5 BEDS/1,000	4.45	5.56	4.75
($1990 BILLIONS, 1990-2021) @ 3.0 BEDS/1,000	3.69	4.65	3.93
CENTRAL PROVIDES EDUCATION FACILITIES/ SERVICES MORE EFFECTIVELY AT LESS CAPITAL COST:	◔	◕	◔
- ELEM. & HIGH SCHOOLS ($1990B OVER 1990-2021)	4.71	2.33	3.01
- COLLEGES & UNIVER. ($1990B OVER 1990-2021)	1.69	1.87	1.78
- TOTAL SCHOOLS ($1990B OVER 1990-2021)	6.40	4.20	4.79
NODAL AND SPREAD PROVIDE CULTURAL/ RECREATION FACILITIES AND SERVICES AT LESS CAPITAL COST:	◕	◐	◕
- CAPITAL COST OF URBAN PARKS ($1990B, 1990-2021)	2.32	4.22	2.82
- GENERAL CULT./REC. ($1990B, 1990-2021)*	10.90	10.90	10.90
- TOTAL CULT./REC. ($1990B, 1990-2021)	13.22	15.12	13.72
NODAL PROVIDES SOCIAL AND OTHER HEALTH SERVICES MORE EFFECTIVELY AND EFFICIENTLY	◔	◐	◕
- CAPITAL COST OF SOCIAL AND OTHER HEALTH SERVICES ($1990B, 1990-2021)*	2.68	2.68	2.68
NODAL PROVIDES PROTECTION SERVICES (FIRE, POLICE, AMBULANCE) MORE EFFECTIVELY AND EFFICIENTLY	◔	◐	◕
- CAPITAL COST OF PROTECTION SERVICES ($1990B, 1990-2021)*	2.83	2.83	2.83

NOTE:

* Cost differentiation among the concepts could not be reliably estimated because of limitations on time and available data.

LEGEND: Relative Rating Symbols

High Rating	●
Medium-High Rating	◕
Medium Rating	◐
Medium-Low Rating	◔
Low Rating	○

integrated, highly accessible services) and education facilities/services (the Central Concept allows some currently under-utilized inner city schools to be re-used and makes best use of existing colleges and universities to meet future demands).

Human Services Ratings Summary

Accordingly, Concept 3, Nodal, and Concept 2, Spread, generally have higher ratings under the human services criterion and Concept 1, Spread, has lower ratings under this criterion.

External Impacts

The ratings for the two measures under this criterion are highlighted on Exhibit 17.

Comparison Highlights: External Impacts

Generally, Concept 3, Nodal and Concept 2, Central received the highest ratings in terms of low pressure for urban overspill development into the hinterland adjacent to the GTA (because the outer edges of urbanization would remain farther from the GTA boundary), and Concept 3, Nodal, receives the highest rating in terms of less pressure for GTA oriented ex-urban road traffic (because of its low overspill development and relatively high use of transit). Concept 2 has similar attributes in terms of this measure, but receives a lower rating because of the possibility that higher central population densities would create an increased propensity for some urban residents to move out beyond the GTA boundary in order to experience a low density environment.

Impact of Movement to Existing Cities and Towns Outside the GTA

There is also a discussion in Background Report No. 7 of possible differential impacts by the three urban structure concepts on the propensity for GTA residents to move to existing communities beyond the immediate hinterland environs, such as Hamilton, Guelph, Barrie, Peterborough and Cobourg.

As noted in the earlier discussion, relocations to these communities would not have the type of negative impacts associated with overspill rural development and would likely create less pressure for GTA oriented road traffic, since the satellite cities will tend to be connected to the GTA by rail services. Because of this, and because of the difficulties of assessing how the propensity to move to satellite centres might be affected by the three concepts, no attempt was made to rate the concepts in this regard.

4.2 CONCLUSIONS: CONCEPT COMPARISONS

Based on the foregoing, the general conclusions stemming from the concept comparisons are as follows:

- **capital costs** for all three concepts are large, about $74-$79 billion in 1990 dollars, cumulative over the 31 year period 1990-2021, involving a 42% increase over recent

EXHIBIT 17

EXTERNAL IMPACTS: COMPARISON HIGHLIGHTS

	2021		
	1. SPREAD	2. CENTRAL	3. NODAL
CENTRAL AND NODAL CREATE LESS PRESSURE FOR URBAN OVERSPILL DEVELOPMENT	○	◐	◐
NODAL CREATES LESS PRESSURE FOR GTA ORIENTED EX-URBAN ROAD TRAFFIC	○	◔	◕

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LEGEND: Relative Rating Symbols

High Rating	●
Medium-High Rating	◕
Medium Rating	◐
Medium-Low Rating	◔
Low Rating	○

annual investment levels, but the capital cost differences among the three concepts are insignificant relative to the uncertainty range of the estimates. All three concepts are therefore rated equally in terms of this measure;

- **operating costs** for solid waste disposal are similar across all three concepts, but there are more significant differences in transportation operating costs, with Concept 1, Spread, having the highest annual transportation operating costs in 2021 ($12.0 billion), Concept 2, Central having the lowest ($9.9 billion) and Concept 3, Nodal having intermediate costs ($11.1 billion) under this measure. Most other operating costs were treated qualitatively owing to study scope and time limitations. Concept 2 is therefore rated highest and Concept 1 lowest under this measure;

- **urban structure**: Concept 3, Nodal, generally receives higher ratings, followed by Concept 2, Central and then by Concept 1, Spread. Concept 2 would consume significantly less rural land for urbanization but Concept 3, Nodal, is seen as superior in terms of having less growth impact on existing community character, providing a wider range of community sizes, and providing a broader range of community diversity in housing types/ownership, densities and mix of residential and job activity;

- **economic impetus**: Concept 2, Central, would have the lowest impact on agriculture, forest products and mineral resource activities in the GTA and would have the lowest cost push impact on land development costs, but could have a higher risk of a land supply/demand imbalance which could lead to price increases for land, housing and employment facilities, depending on the manner in which the required growth management is carried out if this concept were adopted;

- **transportation**: Concept 2, Central, generally receives higher ratings because of shorter trips, greater transit use and generally lower transportation effort, followed rather closely by Concept 3, Nodal in terms of similar measures. Concept 1, Spread, would be superior in terms of the road network extent and level of service in the suburbs and in terms of intercity connections and access to rural areas, but would have substantially higher levels of transportation effort, (e.g. average trip distance) and operating costs, and a greater possibility of road congestion in central areas

because of the practical difficulty of building the necessary roads in build-up areas;

- **hard services**: all three concepts are essentially equal in terms of trunk water and sanitary sewerage systems and solid waste management costs, reflecting the postulated distributions of people and jobs. Concept 2, Central, rates highest in terms of its low land development/redevelopment/ local servicing costs, with Concept 1, Spread having the lowest rating (highest cost) and Concept 3, Nodal, having an intermediate rating closer to that of Concept 2 than Concept 1;

- **greening/environment**: Concept 2, Central, generally has higher ratings under the measures of this criterion, followed fairly closely by Concept 3, Nodal. An exception to this is the high rating of Concept 1, Spread, in terms of its having the lowest need (and cost) to acquire new passive green land in the urbanized area, whereas Concept 1 would have a substantially higher cost in this regard followed by a slightly lower cost for Concept 3 in order to achieve equal levels of passive open space within the urbanized area under each concept. If the alternative approach is taken of providing equal areas of passive open space in the same overall area (e.g. the urbanized area of Concept 1), all three concepts would have the same capital cost for passive green space but residents would have to travel farther, on average, to experience such space in Concept 2 (and to a lesser extent, in Concept 3) than in Concept 1.

- **human services**: Concept 3, Nodal, and Concept 2, Central, generally have higher ratings under this criterion. An exception is the cultural/recreation measure, in which Concept 1, Spread, is rated as high as Concept 3, Nodal because of its relatively low capital cost for urban parks, while Concept 2, Central, is rated lowest in this regard because of the higher requirement and cost for urban parks to serve the higher central population densities under that concept;

- **external impacts**: Concept 3, Nodal, generally receives higher ratings under this criterion since, in common with Concept 2, it is anticipated to create less pressure for GTA overspill (low density) development in the rural hinterland adjacent to the GTA and this, coupled with its higher level of transit service and use in suburban areas, is likely to

create less pressure for GTA oriented road traffic in the hinterland.

4.3 CONCLUSIONS: QUALITY/COST TRADE-OFFS

Earlier sections have noted that the substantial capital cost investments required for all three urban structure concepts relate to the level of service (quality standards) assumed in these analyses. Generally, the analyses were based on the assumption that sufficient infrastructure should be provided to achieve a similar level of service to that experienced in 1986 in the GTA, as the "basic" level of service. In addition, in one or two instances, cost estimates were provided (and included) for infrastructure investments to **improve** the level of service provided.

There are four subcomponents of the infrastructure capital cost estimates which are significant in this regard, two of them falling under the transportation criterion and two under the greening/ environment criterion, as follows:

- **transit**: substantial investment levels are estimated for improved transit under all three concepts, particularly Concept 2, Central with an estimate of $14.4 billion. This level of investment (about $460 million per year on average) would be essential in the view of the study team in order to serve the Central Concept and provide an acceptable alternative to the automobile mode, and approximately half that level of investment (about $230 million per year) would be required for improved transit even under the Spread Concept with its emphasis on an extended and improved road network;

- **roads**: the extensive capital investments estimated for new/improved roads ($19.9 billion for Concept 1, $17.0 billion for Concept 3, and $13.2 billion for Concept 2) are based on the premise that additional roads would be built such that equal levels of service would be provided under all three concepts. The cost estimates were based on the assumption that sufficient new lane-km of roads would be added to provide peak period travel speeds similar to those experienced in 1986 throughout the GTA. This subcomponent is the largest single contributor to the estimated capital costs, comprising about 25% of the estimated total. It is possible that such a level of investment would be considered too high and the alternative of increased road congestion in central and/or suburban areas would be tolerated instead. If this were the case, Concept 2, Central, would experience the least

negative impact from such a shortfall while Concept 1, spread, would have the greatest negative impact and the impact on Concept 3, Nodal, would be intermediate;

- **passive open space**: the initial assumption under this measure was that sufficient passive open space would be purchased **within** the urbanized area under each concept to meet the current standard of 1.8 ha per 1,000 people. It is probable that the significant cost and physical dedication of large land areas to passive open space use in existing urbanized areas ($6.0 billion under Concept 2, $4.7 billion under Concept 3 and $1.1 billion under Concept 1) would be considered to be too high for Concepts 2 and possibly 3, such that lower passive open space standards would be accepted. This could be achieved, as noted earlier, by providing the necessary passive open space in **the same area** (e.g. the urbanized area of Concept 1) for all three concepts. Under this assumption all three concepts would have the same capital cost for passive open space ($1.1 billion) but residents in Concept 2 (and to a lesser extent Concept 3)) would have to travel farther, on average, than would suburban residents in Concept 1, to experience the passive space located in suburban areas.

- **storm water quality**: as described more fully in Background Report No. 5, measures are currently in place to improve the quality of storm water runoff in new suburban areas through measures such as settling ponds. Partial treatment of retained storm water by water pollution treatment plants during off-peak periods is a future possibility. Polluted storm water runoff, sometimes mixed with sanitary sewage because sanitary/storm sewer separation has not been completed, still remains a major problem, however, and severely degrades the quality of GTA river valleys and lakefront amenities. The existing urbanized areas, and particularly the central areas, are increasingly the major problem in this regard. It would be possible to spend very large sums to address this problem but it is difficult to estimate their magnitude and, accordingly, we applied a general estimate of about $2 billion to all three concepts. Concept 2, Central, would probably provide the greatest opportunity to reduce storm water runoff pollution because retention/treatment facilities could be installed more economically as part of the extensive redevelopment which would occur in central areas under that concept. If it were decided that this level of

expenditure could not be maintained to improve the quality of storm water runoff, the greatest loss of opportunity would be experienced under Concept 2, followed in turn by Concept 3 and then Concept 1, but the beaches and river valleys would experience continuing negative impacts under all three concepts.

Clearly, trade-off decisions between levels of capital investments and the resulting functional/environmental standards achieved will require broad input from elected officials, staff, interest groups and the public at large. Increasing concerns regarding environmental quality and required actions to achieve sustainable development in this context will undoubtedly play an important role in this process. The strategic estimates presented here, and the discussion of some basic trade-offs, are intended to facilitate this discussion and consequent decisions.

4.4 SUMMARY: CONCEPT TRADE-OFFS

Emerging from the above ratings and the quantitative projections on which they are based are a number of essential features about each of the three concepts, as follows:

- **Concept 1, Spread:**
  - this concept is the least compatible with sustainable development in that it would consume the greatest amount of rural land and related agricultural productivity and natural resources, would use the most energy and produce the most air pollution because of its higher travel effort and greater reliance on automobiles, and would provide less opportunity to enhance storm-water quality and dispose of toxic soils in central, built-up areas than would be the case for Concept 2 and, to a lesser extent, Concept 3;
  - Concept 1 is, however, closest to the status quo in terms of delivery of new housing, lifestyles, and government planning/regulation affecting urban development.

In some ways, therefore, Concept 1 is the least risky, since it would require less change from the status quo. In the longer term, however, it carries the highest risk since it would place greater negative pressures on the environment and on natural resources including energy sources and agricultural land. The environmental risk relates strongly to recent evidence that transportation activities, and particularly automotive

transportation emissions, are contributing significantly to acid precipitation, global warming, ozone depletion at high levels, and local toxic effects in and around urban areas.

- **Concept 2, Central:**

    - this concept makes the most efficient use of resources (e.g. land, energy) and places the least negative load on the environment;

    - however, it would require the greatest amount of government regulation in order to divert population growth from suburban areas to central, built-up areas.

  It would require the greatest change from the status quo in terms of population densities and housing types, less automotive travel and greater use of transit, and growth management policies/programs, with the risks that are inherent in any significant change from the status quo. On the other hand, it would provide the greatest likelihood of achieving sustainable development and avoiding, in the longer term, the apparently inexorable growth of suburban automobile traffic as it is increasingly experienced in large North American cities;

- **Concept 3, Nodal:**

    - this concept builds on existing communities and their urban infrastructure such as civic buildings, commuter rail stations, transportation and other local infrastructure, while providing for continuing growth both in the suburbs and in the central, built-up areas but at higher densities of suburban development than under Concept 1;

    - it would appear to provide the greatest range of choice in terms of population densities and housing types, community size and character, suburban and downtown living styles, available range of transportation modes, and integrated delivery of human services, while reducing per capita resource requirements and pollution levels relative to Concept 1.

Generally, it would be intermediate between Concepts 1 and 2 regarding its compatibility with sustainable development, the required level of government regulation and other comparison measures, with high rankings in terms of urban amenities, human services and external impacts on the GTA hinterland.

- **Costs:**

  - although minor capital cost savings might be achieved with Concept 2 and, to a lesser extent, Concept 3 relative to Concept 1 (if lower accessibility standards to passive open space were accepted under these concepts) the differences are not significant relative to the overall size of the capital investment for any of the three concepts and the range of uncertainty in the estimates;

  - transportation operating costs would be significantly less for Concept 2 than Concept 1 (about $2 billion per year difference) and Concept 3 would have an intermediate level.

  In terms of capital costs, therefore, the similarity suggests that choices among the concepts (or hybrid versions of them) will focus more on the functional and qualitative aspects of the concepts than on their capital costs.

An Informed Debate

An informed debate on the most appropriate future urban structure for the Greater Toronto Area will focus, therefore, on the relative importance to the people and leaders of the metropolis of basic urban objectives:

- an efficient, pleasant and diverse urban ambience;

- continuing opportunities for and encouragement of economic growth;

- efficient, reliable, convenient and environmentally-benign transportation;

- cost-effective hard services;

- preservation and enjoyment of green areas and related water resources and achievement of sustainable development such that environmental

quality is maintained or enhanced and natural resources conserved;

- effectiveness/efficiency of human services; and

- positive rather than negative impacts on the adjacent hinterland.

Debate regarding the relative importance of, and trade-offs among, the above types of objectives, in the context of information provided by this preliminary study, will, it is hoped, provide a sound basis for decisions on future directions for the GTA.

4.5 POSSIBLE NEXT STEPS

As stated earlier, the purpose of this study is to provide information and initial opinions regarding the infrastructure, cost and related qualitative implications of the three urban structure concepts studied. This is not a planning study, in that no recommendations are made regarding a preferred concept, and a conceptual level of detail and analysis is used.

It is hoped that the strategic information provided will provide a basis for productive discussion by those concerned with urban development/ infrastructure planning and delivery throughout the GTA and that, from this, a consensus will emerge regarding a preferred direction.

Hybrid Concepts

It is possible that a preferred urban structure concept may emerge from this process in terms of one of the three generic concepts analyzed in this study. It is also possible that many of those involved might identify a preference for combining certain attributes of one of the concepts with those of another, to produce one or more "hybrid" urban structure concepts. Investigation of such hybrid concepts was beyond the scope of this initial study, but identification and analysis of one or more such concepts may be a logical next step, following consideration and public discussion of results from the current study.

Quality/Cost Considerations

It was noted in Section 4.3 above that the substantial capital cost investment levels estimated in this study relate strongly to transportation improvements, both to address service level shortcomings accumulated during the past decade or more and also to accommodate the demand for new growth, at service levels equivalent to those provided in 1986. Significant, but substantially lower levels of investment were also included to maintain a range of passive open space standards within the urbanized area under the three concepts and to improve the quality of storm water runoff, which is currently degrading recreational opportunities and environmental quality in the lakefront areas and river valleys of the GTA.

Again, decisions regarding investment levels relative to quality standards require careful consideration, and it is likely that more detailed study of these trade-offs will be required as a basis for such decisions. In the meantime, the strategic information provided by this study is intended to help inform the discussions and focus on-going actions regarding both issues: the preferred urban structure concept, and the level of investment those concerned with the future of the GTA are prepared to make to achieve desired functional and environmental standards.

Preliminary, for Discussion

This study breaks new ground by drawing together demand, supply, cost and effectiveness findings for three quite different future urban forms for the entire GTA including both "hard" and "soft" infrastructure. There is, therefore, little precedent against which to assess the results, some of which are perhaps unexpected or at least thought-provoking. The results are therefore preliminary, for discussion. If, as the findings are scrutinized and the comparison ratings are discussed, a consensus emerges regarding a preferred future urban structure for the GTA and/or a process for moving purposefully in that direction, the study will have served its purpose.